Consolidated Space Operations Contract

Data Services Management Center (DSMC) System Requirements Specification

August 29, 2003

Effective: August 29, 2003

Contract Number NAS9-098100

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Preface

The Consolidated Space Operations Contract (CSOC) prepared the Data Services Management Center (DSMC) System Requirements Specification for the Network Control Center Data System (NCCDS).

The primary responsibility is with GSFC Engineering. Questions concerning the technical content of this document should be directed to John Russell, 301-805-3795, NCCDS Software Sustaining Manager.

This document provides the detailed requirements for the NCCDS, as it becomes a component of the Data Services Management Center at the White Sands Complex (WSC) in New Mexico. It originates from The *Network Control Center Data System (NCCDS) System Requirements, 1998, 451*-SRD-NCCDS/1998 document, which provides the detailed requirements for the Network Control Center Data System (NCCDS) for the purpose of developing, integrating, and testing the version of the NCCDS that became fully operational in February 1999 (i.e., the version known as NCCDS 1998). This new document is a republished version of that document, with additional requirements as they pertain to the DSMC, and will become the single requirements baseline document governing all NCCDS specifications once the NCCDS has been successfully relocated and becomes operational at the White Sands Complex (WSC). It will be used to regression test existing elements of the NCCDS as well as evaluate and critique the design, development, and implementation of all new NCCDS elements.

Table of Contents

Section 1. Introduction

1.1 Purpose

This document specifies detailed requirements for the Network Control Center Data System (NCCDS). Its contents originated from the legacy document *The Network Control Center Data System (NCCDS) System Requirements, 1998* (document number .451-SRD-NCCDS/1998). Updates and additional requirements were included in this document, which address the relocation of the NCC to the White Sands Complex (WSC) as it becomes a component of the Data Services Management Center (DSMC). The DSMC is being created under the DSMC Project Commitment Document (PCD) initiative of the Consolidated Space Operations Contract (CSOC) in an effort to reduce the cost of operations support across the NASA networks. In the creation of this facility GN and SN, operations will be centralized, allowing streamlining of functional duties across personnel.

Changes from the legacy NCCDS 1998 version of this document include the removal of all references to the Megamux interface between the NCC and the WSC, as this interface will no longer be necessary. In addition, 5 new sections were added at the end of the document addressing the following:

a. Section 14: GN Scheduling Services. The Wallops Orbital Tracking and Range Scheduling (WOTRS) engine will be updated to accommodate GNSSR scheduling functions

b. Section 15: Scheduling Web Interface Services. World Wide Web access will be added to allow users to submit GN (WOTRS/GNSSR) and SN schedule requests through a common user interface. Note: existing UPS interfaces will continue to be supported.

c. Section 16: Schedule Accounting Segment Replacement. The existing SAS subsystem will be replaced with an enhanced version, augmented to perform service accounting for GN scheduled activities as well as for SN.

d. Section 17: Firewalls. This section is intended to extend the existing section on security (Section 10) due to the added security implications of allowing WWW access to the DSMC.

It should also be noted that due to the consolidation of the NCC with the WSC facilities, this document will become one of multiple requirements documents defining the contents of the DSMC. For this reason The Data Services Management Center (DSMC) System Requirements Specification for the White Sands Complex (WSC) (formerly The WSC Requirements Specification, document number 530-RSD-WSC) should be considered a companion document to this document.

Additional information on the DSMC initiative can be found in the DSMC PCD CSOC document number CSOC-CEN.PI0.000009.00.

1.2 Background

1.2.1 NCC Overview

The Network Control Center (NCC) is an element of the National Aeronautics and Space Administration (NASA) Space flight Tracking and Data Network (STDN). The STDN uses the Tracking and Data Relay Satellite System (TDRSS) as the primary source of support for customer spacecraft. The STDN includes the Tracking and Data Relay Satellites (TDRSs) and the ground stations of the Space Network (SN) and the Ground Network (GN). The two SN ground stations [i.e., the White Sands Ground Terminal (WSGT) and the Second TDRSS Ground Terminal (STGT)] and all of the GN ground stations are linked to the NCC at the Data Services Management Center (DSMC), which serves as the central control facility of the STDN. The NCC is responsible for network scheduling, acquisition support, data quality assurance, performance monitoring, and overall coordination of the STDN. The NCC is responsible for scheduling and controlling the SN and the GN.

1.2.2 Security

1.2.2.1 Sensitivity/Criticality Level

The *NASA Automated Information Security Handbook*, NHB 2410.9A, defines four automated information sensitivity/criticality (SC) levels. Of these four levels, SC 3 is the most sensitive. In part, SC 3 implies that inaccuracy, alteration, disclosure or unavailability of such information could permanently violate the integrity of NASA's missions. Some of the information handled by the NCCDS has been determined to be SC 3 information. However, none of this information is classified.

1.2.2.2 Security Mode

It has been determined that it would be neither feasible nor beneficial to require the NCCDS to separate SC 3 information from other information at lower SC levels. Hence, the NCCDS operates in system high mode with all information handled as if it were SC 3 information.

1.2.2.3 Security Requirements

The NCCDS must meet the security requirements applicable to a system high sensitive unclassified domain at the SC 3 level.

1.3 Precedence

This document, the *NCCDS System Requirements, 1998*, takes precedence over any higher level or older documents in case of conflict related to the NCCDS. However, this document is based on the *Network Control Center Data System (NCCDS) Operations Concept, 1998*, and therefore if either of these documents is changed the other should also be updated so that these two documents remain consistent.

1.4 Scope

1.4.1 NCC Detailed Requirements

NCC detailed requirements are currently defined in the following documents:

a. *NCCDS System Requirements, 1998*, 451-SRD-NCCDS/1998.

b. *Network Control Center Ground Network Scheduling System Replacement Requirements,* 451-SRD-NCCGNSSR.

1.4.2 NCCDS Requirements Document Hierarchy

The *Network Control Center Data System (NCCDS) Operations Concept, 1998*, 451-OCD-NCCDS/1998 provides the concepts needed to define the NCCDS functions and operations. The *NCCDS System Requirements, 1998*, establishes the requirements for the NCCDS as a whole. At the next lower level, the *NCCDS System Design Specification, 1998,* 451-SDS-NCCDS/1998, partitions the NCCDS into a collection of hardware and software configuration items, allocates the requirements established by the *NCCDS System Requirements, 1998*, to these configuration items, and establishes the requirements for the interfaces between these configuration items. Figure 1-1 illustrates the NCCDS documentation hierarchy.

1.4.3 NCC and NCCDS

The reader should keep in mind the distinction between the terms NCC and NCCDS as used throughout this document. NCC refers to all resources located in the NCC facility. This includes the NCCDS and all other collocated resources including operations personnel. The NCCDS is

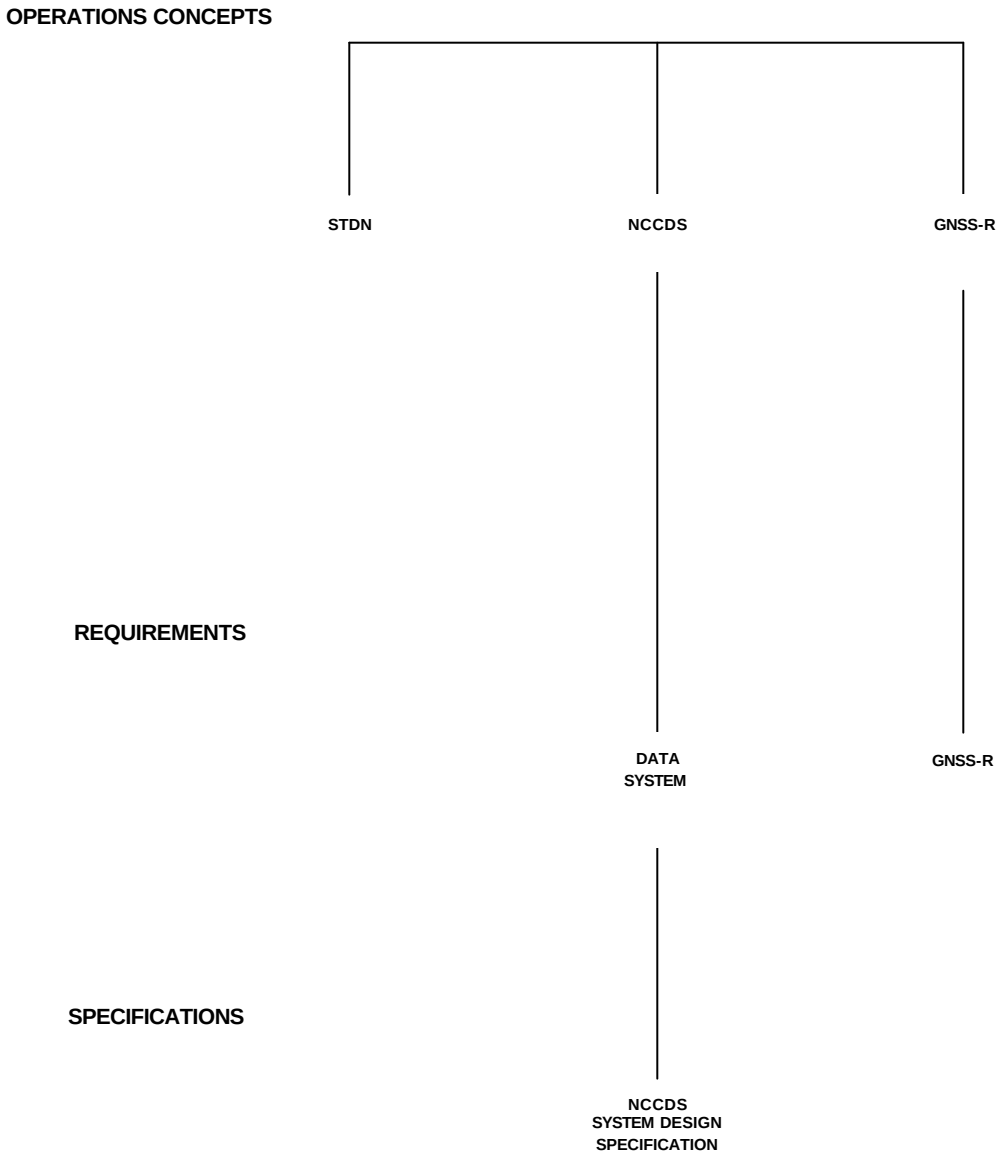

Figure 1-1. NCC Data System Documentation Hierarchy

the collection of computer hardware, computer software, data, data storage devices, display systems, and input/output systems that fulfill the requirements for the NCCDS specified herein.

1.4.4 Requirements and Implementation

Throughout this document functions are listed and presented in a logical way organizing the detailed requirements of the NCCDS. This arrangement is not intended to imply any particular organization for implementing either the hardware or software that will be part of the NCCDS. Similarly, throughout this document, all discussion of data storage is intended only to specify the information content of the data that is required to be stored within the NCCDS, and is not intended to specify a particular data structure or organization, or to specify particular physical data storage devices.

1.5 Ancillary Material

In addition to the detailed functional and performance requirements for the NCCDS, this document contains ancillary material to clarify and summarize these requirements. The reader may distinguish requirements from ancillary material by the way in which several verbs are used within this document. "Shall" expresses a requirement. In particular, "The NCCDS shall . . . " means the same as "The NCCDS is required to . . . " "Will" does not express a requirement on the NCCDS. "Will" is used to state future tense and to express procedural actions or reactions of an operator. "Will" is also used to express assumed actions of other SN elements and customer facilities, the inclusion of which helps the reader in understanding the NCCDS requirements. "Must," "can," "should," and "may" are not used to express requirements on the NCCDS in this document. Also note that when terms such as "include," "includes," and "including" are used to introduce a list, it is intended that lower level specification and design documents may expand the list.

1.6 Italics and Notes

1.6.1 Italics

In a few instances, this document includes requirements that have not been implemented. Such unimplemented requirements are included only when they are directly traceable to external requirements. *Such unimplemented requirements are printed in italics (i.e., the typeface of this sentence).*

1.6.2 Notes

Within this document, notes are used to present several different types of information including:

- Clarifications.
- Background information.

- Non-obvious implications of certain requirements or combinations of requirements.
- Limitations of the current implementation.

1.7 NCCDS Implementation Guidelines

Two key guidelines apply to the NCCDS implementation:

a. Parameterization. For simplicity, many of the functional and data requirements applicable to the NCCDS are stated in terms of numeric constants. The given values are realistic as of 1999. However, it is intended that the NCCDS is to be implemented in a way that will allow these "constants" to be changed without software modification. For example, it is stated that each of the two TDRSS ground terminals contains three space-to-ground link terminals (SGLTs) and that each of the SGLTs can support up to 5 multiple access return (MAR) links. Modification of the NCCDS to make it capable of scheduling different numbers of MAR links per SGLT should be possible via database changes.

b. Extendibility. Specific requirements can only be stated in terms of well-defined characteristics of the SN environment. However, the SN environment will change throughout the NCCDS's lifecycle. Therefore the NCCDS must be implemented so that it can be extended in response to changes in the SN environment. For example, all current requirements for providing SN support are stated in terms of scheduled support. Within the NCCDS's lifecycle, there may be requirements for demand access support.

Section 2. Applicable and Reference Documents

2.1 Introduction

The documents listed in this section are either applicable to the NCCDS requirements or may be referenced as background information concerning the NCCDS requirements. In general, revision numbers are not shown and the most recent approved version of each document should be used.

2.2 Applicable Documents

a. *Interface Control Document Between the Network Control Center Data System and the Sensor Data Processing Facility,* 451-ICD-NCCDS/SDPF.

b. *Interface Control Document Between the Network Control Center Data System and the Mission Operations Centers,* 451-ICD-NCCDS/MOC.

c. *Interface Control Document Between the Network Control Center Data System and the NASA Integrated Services Network (NISN)/NASA Communications (Nascom) Event Scheduling Terminal (NEST),* 451-ICD-NCCDS/NEST.

d. *Nascom Interface Standard for Digital Data Transmission,* 542-003.

e. *IRIG Standard Parallel Binary Time Code Formats,* IRIG STD 128-77.

f. *Network Control Center Data System (NCCDS) System Design Specification, 1998,* 451-SDS-NCCDS/1998.

g. Space Network (SN) Security Classification Guide (SCG).

h. *Interface Control Document Between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC),* 530-ICD-NCC-FDF/WSC.

i. *NASA Automated Information Security Handbook*, NHB 2410.9A, June 1993.

j. *NASA – Goddard Space Flight Center Security Manual*, GHB 1600.1A, November 1990.

k. Nascom Operating Procedures (NASCOP).

l. *Security Plan for the Network Control Center, NCC 98,* 451-SP-NCC/1998

m. *Requirements Specification for the White Sands Complex (WSC), Revision 1*, 530-RSD-WSC, June 1997

n. *Data Services Management Center (DSMC) System Requirements for the White Sands Complex (WSC),* CSOC-CENSE11.001069, August 1999

o. *Consolidated Space Operations Contract Data Services Management Center Project Commitment Document*, CSOC-CEN.PI01.000009.00

2.3 Reference Documents

a. *Network Control Center Data System (NCCDS) Operations Concept, 1998*,451-OCD-NCCDS/1998.

b. *Support Identification Code Dictionary*, 532-808.

c. *Mission Requirements and Data System Support Forecast*, 450-803.

d. *GSFC Specification*, GSFC-S-530-1, *Spare Parts Program*, March 1985.

e. *Nascom Communications (Nascom) Space Network Ground Segment Support Data Book*, 542-016, October 1991.

f. *Spaceflight Tracking and Data Network Mnemonic Dictionary*, STDN No. 520.

g. *Network Control Center (NCC) Communications Link Analysis and Simulation System (CLASS) Automated Conflict Resolution System (ACRS)/TDRSS Look Angle System (TLAS) Requirements*, 534-ACRSTLASR-CLASS.

h. *Wallops Tracking & Range Scheduling (WOTRS) N-Spacecraft Requirements Specification, Version 1.0*, (no document number; prepared for NASA under Contract NAS5-30999, Task #49, by CSC), August 1993

i. *Interface Control Document between the Mission Operations and Data Systems Directorate (Code 500) and the Suborbital Projects and Operations Directorate (Code 800) for GSFC Missions Requiring Support by the Wallops Orbital Tracking Station*, 502-ICD-MODSD/SPOD, February 1996

Section 3. Spaceflight Tracking and Data Network

3.1 Introduction

The STDN consists of the SN, GN, and all support facilities necessary to provide telemetry, tracking, and command services to customers (see Figure 3-1). This section describes the STDN and the role of the NCC in the STDN.

3.2 STDN Elements

3.2.1 General

Brief descriptions of the STDN elements are given below. The STDN includes the following elements:

- SN.
  - TDRSS.
  - NCC.
  - Simulation Operations Center (SOC).
- GN.
- Network support elements.
  - NASA Integrated Services Network (NISN).
  - Flight Dynamics Facility (FDF).

3.2.2 Space Network

3.2.2.1 TDRSS

3.2.2.1.1 General

The TDRSS consists of several geosynchronous TDRSs, the WSGT and the STGT in New Mexico, the Guam Remote Ground Terminal (GRGT), and in-orbit spare satellites. The WSGT, the STGT, and several ancillary facilities compose the White Sands Complex (WSC). Although the GRGT is physically separate from the WSC, it operates as if it was included within the WSGT. A capability exists for launch of a replacement satellite should an on-orbit failure occur. The purpose of the TDRSS is to relay telecommunication signals between low-altitude, Earth-orbiting spacecraft and customer control and data processing facilities, and between near-Earth or Earth-sited systems (e.g., launch and landing) and their operators. The TDRSS also

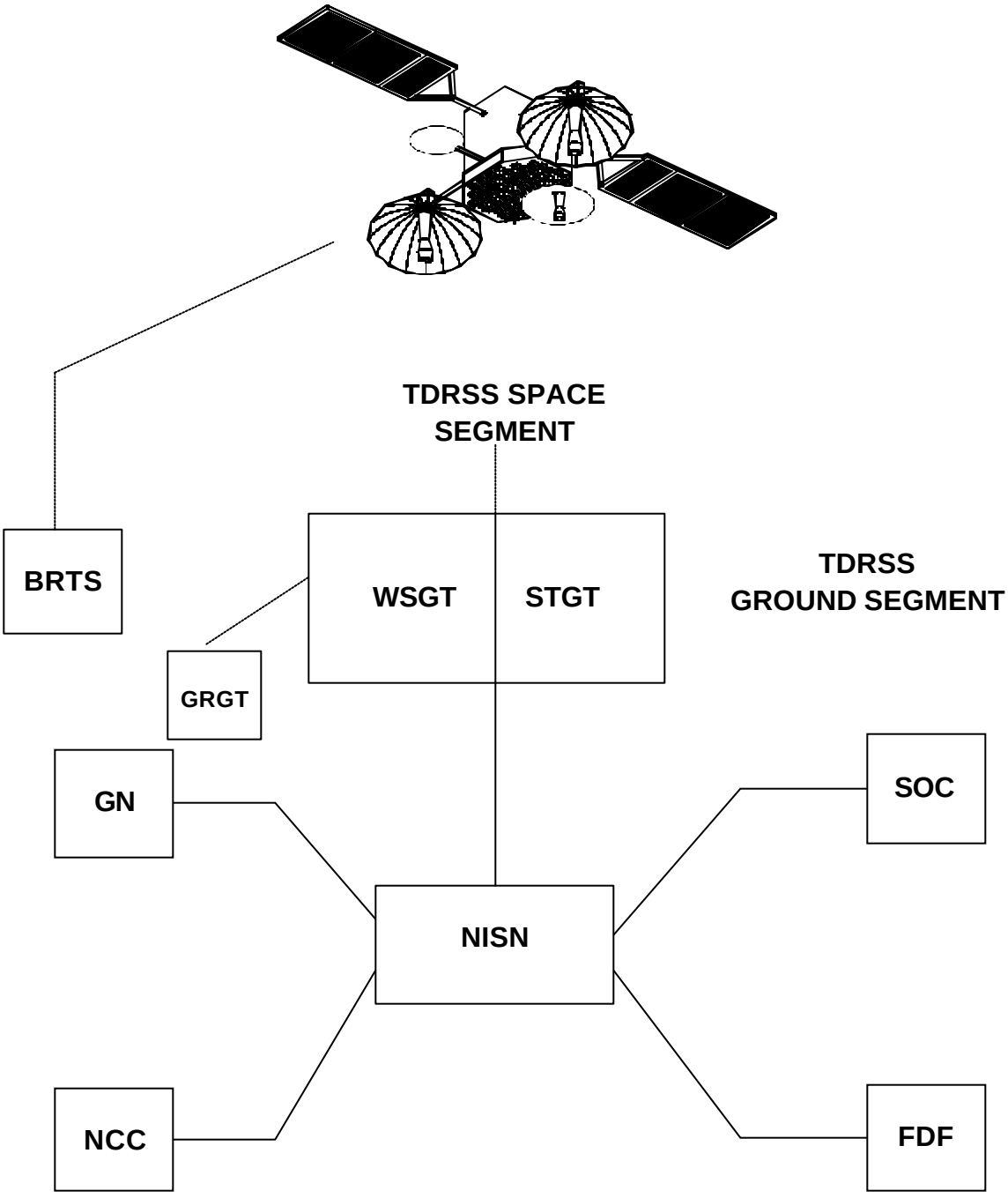

Figure 3-1. NASA Baseline Network

provides similar support to a variety of non-orbiting vehicles such as balloons, aircraft, and expendable launch vehicles (ELVs).

3.2.2.1.2 Operations

WSGT and STGT operate in accordance with a schedule provided by the NCC and change ongoing service parameters in response to NCC instructions. TDRS antenna pointing angles and Doppler compensation information are determined from detailed spacecraft orbit data. WSGT and STGT compute this information by interpolating between state vectors. The state vectors are provided by the NCC. WSGT and STGT inform the NCC of the status and quality of ongoing services and also of equipment status. Based on WSGT and STGT requests, the NCC schedules WSGT and STGT preventive maintenance (PM) on a service basis.

3.2.2.1.3 End-to-End Test

The TDRSS provides end-to-end test services. To do this, WSGT and STGT have the capability to simulate customer Ku- and S-band communications. This capability will be used to test forward, return, and tracking services.

3.2.2.2 NCC

The NCC provides the operational management and accounting for the STDN. From a customer perspective, the NCC is the operational interface for obtaining mission support. From a network element perspective, the NCC is responsible for providing a work schedule and coordinating problem resolution. NCC management of the STDN includes generating and distributing schedules, preparing configuration control messages, monitoring equipment status (used in scheduling) and configuration, monitoring performance, and performing fault isolation. The availability, use, and performance of services will be reported using monitored information. The NCC does not process customer telemetry and command data. The NCC includes the NCCDS and several ancillary systems. The NCCDS is the NCC's primary tool for performing its SN functions. The NCCDS functions are described in Section 4.

3.2.2.3 Simulation Operations Center

3.2.2.3.1 General

The SOC, located at GSFC, is used in peripheral support activities, including spacecraft-to-network compatibility testing, fault isolation, and performance evaluation. The SOC is able to simulate the NCC, the TDRSS ground segment, a TDRSS customer ground facility, or a TDRSS customer spacecraft to a limited degree.

3.2.2.3.2 Data Flows

The SOC will be used to conduct data flows with other STDN elements to validate message formats, message sequencing, and basic communication capabilities. The SOC can simulate a source or destination for another STDN element or a STDN customer.

3.2.2.3.3 Scheduling

The SOC will be scheduled by the NCC when it is used to support external testing that involves a STDN service.

3.2.3 Ground Network

The GN is the ground-based segment of the STDN. The GN stations will be used primarily for launch and landing events, with some sites also providing some routine orbital support. They will also be used to support TDRS replacement launches and for support of approved contingency operations. A TDRSS relay located at the Merritt Island, Florida, (MIL) STDN station will provide signal routing between the TDRSS and payloads or satellites under test prior to launch.

3.2.4 Network Support Elements

3.2.4.1 NISN

3.2.4.1.1 General

The NISN provides common-carrier communication services among the TDRSS ground segment, Johnson Space Center (JSC), Marshall Space Flight Center (MSFC), and GSFC using a wideband data system interfaced through a multiplexer/demultiplexer (MDM) system and a high data rate multiplexer (HDRM) system. As part of the NISN, MDM and HDRM units are located at the TDRSS ground segment, JSC, and GSFC. The MDM baseline composite transmission service will be up to 8 megabits per second (Mb/sec) to and from the TDRSS ground segment. Spacecraft data with rates up to 2 Mb/sec normally will be transmitted from the TDRSS ground segment by the MDM. Spacecraft telemetry data with higher rates will be transmitted by the HDRM, which is capable of transmitting up to four channels of data simultaneously with a maximum composite data rate of 48 Mb/sec. Data from the TDRSS ground segment is transmitted to JSC and GSFC simultaneously. Data to the TDRSS ground segment from GSFC and JSC will be transmitted via the MDM or via the WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC). In addition, NISN provides television, voice, and systems control circuits.

3.2.4.1.2 Operations

The majority of NISN resources within the STDN normally operate in a data-driven manner and do not need to be explicitly scheduled by the NCC. However, the NCC does make scheduling and reconfiguration information available to the NISN Event Scheduling Terminal (NEST) for accounting and troubleshooting purposes, and for set-up of some equipment.

3.2.4.1.3 Administrative Communications

NISN provides all communications circuits needed for administrative communications among the GN, GSFC, JSC, the WSC, and the NCC.

3.2.4.2 Flight Dynamics Facility

3.2.4.2.1 General

The FDF provides orbit-related data for spaceflight missions from early planning through the end of the operational phase. The FDF is responsible for receiving, validating (in real time), calibrating, and archiving STDN tracking data. Based on tracking data received, the FDF will provide the spacecraft/payload NASA transponder frequency history to each customer. The FDF provides orbit data used in developing trajectory information, acquisition data, and scheduling aids. The FDF also acts as the operations control center for the Bilateration Ranging Transponder System (BRTS).

3.2.4.2.2 Bilateration Ranging Transponder System

The BRTS consists of transponders located in surveyed positions around the globe. The transponders are position references for TDRS orbit computations. BRTS tracking signals are normally routed through TDRSS multiple access (MA) services. These signals are used to measure the range between the TDRS and each transponder, and to collect BRTS status data. This data is routed to the FDF where the TDRS position is determined and the BRTS performance capability is monitored.

3.2.4.2.3 NCC Data

The FDF routinely provides acquisition data to the NCC. The NCC will request additional data when needed.

3.3 STDN Customers

3.3.1 General

The STDN supports customers with common services and minimizes the need for mission-unique equipment. Each customer sends schedule requests and reconfiguration requests to the NCC. The customer receives SN performance data and schedule information from the NCC. The SN performance data gives the customer an indication of the quality of service being provided. The STDN customers are grouped into three categories:

- Free flyers.
- Space Shuttle and payloads.
- Other customers.

3.3.2 Free Flyers

This class of customers operates satellites that require services through the STDN. For these customers, the mission support requirements vary greatly. A summary of the various missions is contained in the *Mission Requirements and Data System Support Forecast*.

3.3.3 Space Shuttle

The Shuttle carries into space virtually all of the Nation's payloads for the U.S. Government, private industry, universities, and research organizations. The Shuttle also carries payloads for foreign governments and international organizations. Standard Shuttle operations include attached payloads such as the Spacelab and detached payloads such as free flyers, with or without propulsion stages for higher altitude orbit insertion.

3.3.4 Other Customers

SN support by the FDF varies depending on the specific payloads and mission profiles. The FDF is unable to provide acquisition data and scheduling aids for some customers. Those customers will provide the acquisition data when FDF support is not provided.

3.4 Customer Support Facilities

3.4.1 General

Customer support facilities, such as the Sensor Data Processing Facility (SDPF), process telemetry data for Earth-orbiting free-flyer payloads. The customer support facility provides for data input capture, accounting, decommutation, and storing and forwarding of standard products. The customer support facility also processes image data and provides rectification, calibration, and customer/experimenter products such as computer-compatible tapes, film, prints, and plots. Project-unique requirements and unique data products can be provided to a customer under formalized agreements.

3.4.2 Scheduling

In response to requests from customers who specify a customer support facility as a destination for return service data, the NCC schedules the flow of data to the specified customer support facility and provides that facility with schedules. The customer support facility prepares to receive and process telemetry data based on the schedule. In response to requests from customers to reconfigure ongoing services, the NCC notifies the SN elements and the customer support facility of such reconfigurations. During ongoing services, the customer support facility will adjust to any reconfiguration affecting the flow of return data to the customer support facility.

3.5 NCCDS External Interfaces

Figures 3-2 shows the interfaces between the NCCDS and the SN customers, TDRSS ground terminals, and network supporting elements. Table 3-1 explains the annotations of Figure 3-2.

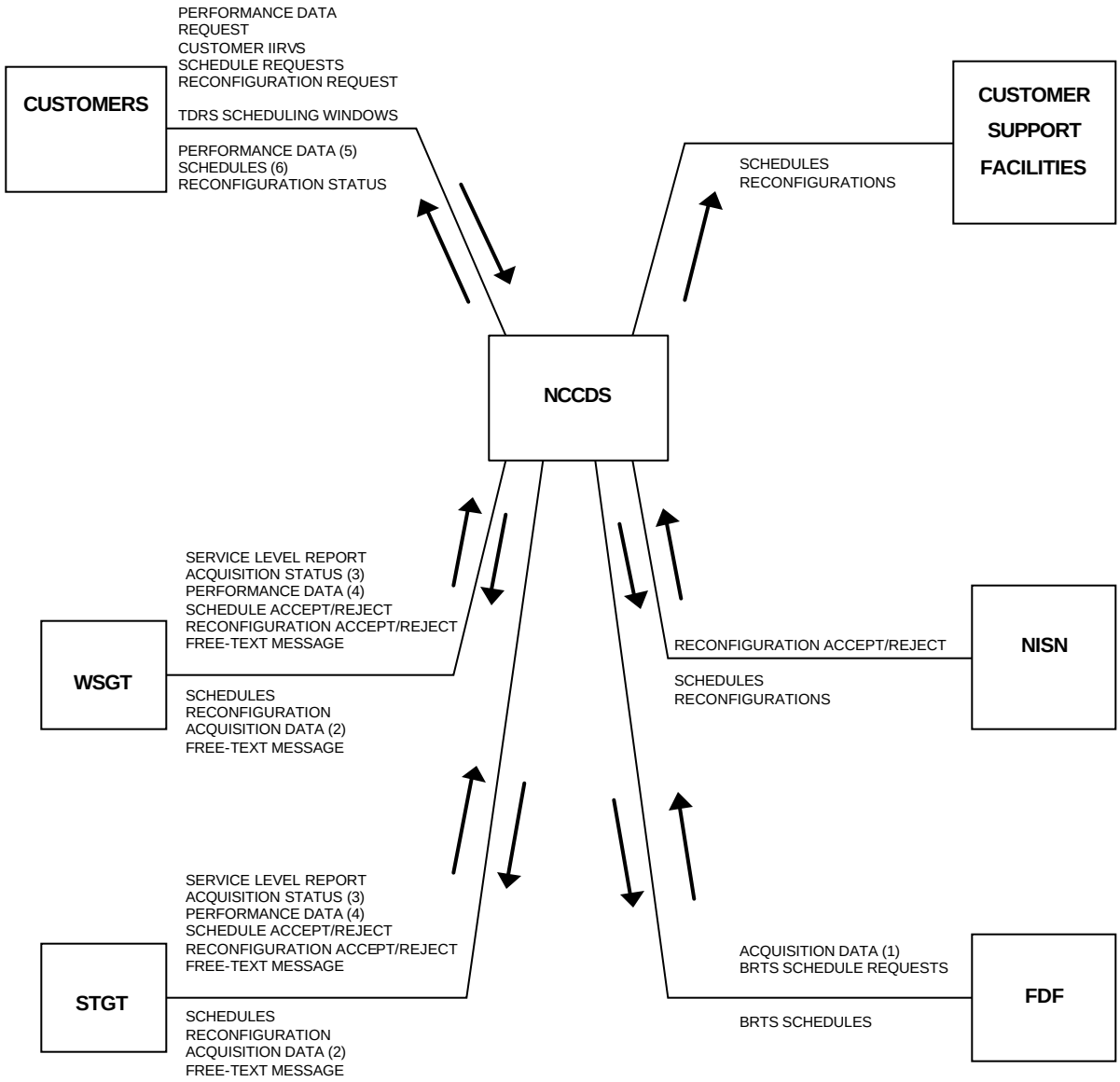

Figure 3-2. NCCDS External Interfaces

Table 3-1. Explanation of Terms On External Interfaces Figure

1. Acquisition data from FDF include:
   - Customer IIRV
   - TDRS IIRV
2. Acquisition data to STGT and WSGT include:
   - Customer IIRV
   - TDRS IIRV
   - Delta-T
3. Acquisition status from STGT and WSGT include:
   - State Vector Reject
   - Real-Time Mode
   - Delta-T Reject
4. Performance data from STGT and WSGT include:
   - ODMs
   - Return Channel Time Delay
   - Acquisition Failure Notification
   - Time Transfer
5. Performance data to customers include:
   - User Performance Data
   - Return Channel Time Delay
   - Acquisition Failure Notification
   - Time Transfer
6. Schedules to customers include:
   - Schedule
   - Schedule Result
   - TDRSS Unscheduled Time

Section 4. System Functions

4.1 Introduction

Because the NCCDS must be capable of processing and handling sensitive information, its functions must be performed in a secure environment. The need for protection of information contained in the NCCDS applies to all levels of the functional requirements. To carry out its responsibilities, the NCCDS will perform the following five functions:

- Service planning.
- Service control.
- Service assurance.
- Service accounting.
- System operation.

4.2 Service Planning

4.2.1 General

Service planning generates a conflict-free schedule for use of SN resources based on requests for support, TDRS Scheduling Windows (TSWs), and resource availability. The process provides for adjusting the schedule based on customer requests, changes in network status, and revisions to customer TSWs.

4.2.2 Services

The services scheduled for customers are real-time data transport (digital and analog/video), tracking, playbacks, and end-to-end tests. When requested, PM and local simulation/test periods are scheduled for the WSGT and the STGT.

4.2.3 Resources

The resources scheduled by the NCCDS are as follows:

a. TDRSS services.

   1. Multiple access forward (MAF).
   2. MAR.
   3. S-band MAF (SMAF).
   4. S-band MAR (SMAR). [Refer to Note 4.2.3-1.]

NOTE 4.2.3 – 1

SMAF and SMAR services are available only on TDRSs H, I, and J. MAF and MAR services are available only on earlier TDRSs. The MAF and MAR services for earlier TDRSs are also S-band services; however, this designation is not included within their names.

5. S-band single access forward (SSAF).
6. S-band single access return (SSAR).
7. Ku-band single access forward (KuSAF).
8. Ku-band single access return (KuSAR). [Refer to Note 4.2.3-2.]

NOTE 4.2.3 – 2

In many TDRSS-related documents, Ku-band services are referred to as K-band services.

9. Ka-band single access forward (KaSAF).
10. Ka-band single access return (KaSAR). [Refer to Note 4.2.3-3.]

NOTE 4.2.3 – 3

KaSAF and KaSAR services are available only on TDRSs H, I, and J. KuSAF and KuSAR services are available on all TDRSs.

11. Normal tracking.
12. Cross tracking.
13. End-to-end test.

b. Antennas.

1. Single access (SA) number 1 on each TDRS.
2. SA number 2 on each TDRS.
3. MAF or SMAF on each TDRS.
4. MAR or SMAR on each TDRS. [Refer to Note 4.2.3-4, 5.]

NOTE 4.2.3 – 4

TDRS H, I, and J have SMAF and SMAR antennas. Earlier TDRSs have MAF and MAR antennas.

NOTE 4.2.3 – 5

Each TDRS has a single MAR or SMAR antenna. The number of available schedulable links through each MAR or SMAR antenna depends upon associated ground equipment, and may range from 0 through 5.

c. Interface channels.

   1. STGT and WSGT MDM port addresses.

   2. Customers on GSFC digital matrix switch (DMS).

   3. JSC on Nascom/Mission Control Center interface [MDM/Shuttle Data Select Switch (SDSS)].

d. End-to-end test.

   1. KuSA.

   2. S-band (multiple access or single access).

e. Transport services.

   1. NISN MDM system.

   2. NISN HDRM/analog/video high-data-rate system.

   3. NISN television services.

   4. NISN common-carrier interface (CCI).

f. Front-end services

   1. Data rate buffering.

   2. Local source/destinations.

   3. Tape playback.

   4. Type I (i.e., low rate) and type II (i.e., high rate) data transfer.

   5. Data quality monitoring (DQM).

   6. Analog/video processing.

4.3 Service Control

Service control is the NCCDS function through which SN resources are controlled. This function includes the following:

a. Dissemination of the service schedule and updates to affected elements and customer facilities.

b. Dissemination of data used to determine TDRS antenna pointing angles and link Doppler shifts.

c. Provision of the means for a customer to change some characteristics of the service in progress for his spacecraft.

d. Dissemination of SN performance data to customers.

4.4 Service Assurance

Service assurance is the NCC function that ensures the quality of SN-provided services. In this role, the NCCDS monitors performance data received from WSGT and STGT in the form of Operations Data Messages (ODMs). Anomalies are brought to the attention of an NCC console operator who will determine what, if any, actions are required. The NCCDS also provides a capability to predict periods of terrestrial-based radio frequency interference (RFI) with SN customer spacecraft, and to predict periods of mutual interference (MI) among SN customer spacecraft.

4.5 Service Accounting

As part of its database, the NCCDS maintains a log of all provided network services. Service accounting is the NCCDS function that uses this data to produce reports that will be made available to management for assessment of network performance. The NCC analyzes service accounting data and problem reports, and seeks to identify trends that may affect future network services. When trends are identified, NCC management personnel will contact representatives of the affected network element to discuss possible causes and remedies.

4.6 System Operation

System operation is the NCCDS function that controls the operation of the NCCDS. It supports the other functional areas, either directly or indirectly. It deals with the interactions of personnel, hardware, and software. This area also addresses the operator-system interface and external communications.

Section 5. Service Planning

5.1 Introduction

Note: It is understood that the JSC and GSFC MDMs are no longer utilized. However, various lower-level translation mechanisms allow the NCCDS to schedule forward and return user services and to account for their bandwidth as if the MDMs were still in place. The effect of the lower-level translation mechanisms, the message formats, etc. is to create a logical structure that might be termed a "virtual MDM system" that mimicks the logical data flow behavior of the old physical MDM system. For this reason the MDM references have been left in tact. It is anticipated that in the future, once all data flow traffic protocol transitions from the legacy 4800 bit block format to IP, it is assumed that the remaining MDMs will be decommissioned and at that time the associated terminology can also be retired.

5.1.1 General

5.1.1.1 Overview

Service planning is the process through which the NCC plans the use of SN resources and services. The NCCDS is the NCC's primary service planning tool. The NCCDS service planning requirements are partitioned into the following areas:

- Service planning database.
- Schedule messages.
- Scheduling rules.
- Scheduling process.
- Schedule transmission.
- Scheduling displays.
- Event start/stop alerts.
- Performance.
- Backwards compatibility.
- TDRSS Unscheduled Time.

5.1.1.2 Service Planning Timeline

The process of planning the customer services to be provided at a particular time is executed along a timeline that begins well before the time at which the services are to be provided. In

terms of the requirements specified herein, the service planning timeline may be regarded as comprising four major phases:

a. Prerequest activities. During this phase, the service planning database is established. Although the database may be modified at any time, it must be initially established before any other service planning functions can be performed. For any customer, the prerequest activities may begin as early as several years before the first operational services are provided.

b. Schedule request reception. During this phase, the majority of schedule requests are submitted to the NCC by the customers. This typically occurs 2 to 3 weeks before the services are to be provided. Although additional requests can be submitted up until a few minutes prior to event start time, effective scheduling of SN resources can only be accomplished when the majority of schedule requests are submitted prior to the initial schedule generation phase. In addition, effective scheduling of SN resources is enhanced when customers submit requests that allow flexibility with regard to the use of SN resources and with regard to the start times and durations of the services to be scheduled.

c. Initial schedule generation. During this phase, the NCC operator executes one or more batch scheduling runs. At the end of the phase, the NCC operator selects a schedule to be activated. Some of the events in the newly activated schedule may retain some of the flexibility specified by the customer in the original schedule request. The events in the selected schedule are transmitted to the customers. Initial schedule generation and transmission is typically performed once per week for services to be provided beginning 1 week after the schedule generation process is completed.

d. Active period. During this phase, the schedule is updated in response to new schedule requests and network contingencies, and in response to customer-specified parameters that determine when each flexible event is frozen and becomes a fixed event. The active period is further partitioned into a Schedule Add Request (SAR) batch scheduling subphase, a SAR automatic schedule update subphase, and a service subphase. Use of batch scheduling methods during the active period gives the NCC operators greater control over the scheduling process and allows for use of more powerful scheduling tools.

    1. SAR batch scheduling subphase. During this subphase, customers may submit additional schedule requests. Many of these requests (e.g., a request to delete a previously scheduled event) will be processed automatically. However, just as in the initial schedule generation phase, SARs are processed in batch scheduling runs under operator control.

    2. Automatic SAR schedule update subphase. During this subphase, incoming SARs and all other schedule requests are automatically processed without operator intervention. This subphase will typically cover at least 1 to 2 days prior to the service subphase.

3. Service subphase. During this subphase, the scheduled services are provided to the customers. The predominant NCC activities are service control and service assurance, rather than service planning.

5.1.2 Service Planning Database

The NCCDS service planning database contains three general types of data:

a. Space Network data. This data defines a logical model of the SN which is used by the NCCDS in the scheduling process.

b. Customer data. For each customer, this data defines that customer to the NCCDS and specifies how the customer will use the SN. Customer data is organized around customer spacecraft rather than customer facilities or customer projects. If a single facility or project is responsible for more than one customer spacecraft, this may result in the data for these customer spacecraft having certain common elements (e.g., User IDs or message distribution lists). However, this has no effect on the operation of the NCCDS which regards each customer spacecraft as a unique entity.

c. NCCDS scheduling control data. This data is entered by the operator to control the NCCDS scheduling process.

5.1.3 Schedule Messages

Seven categories of messages are used in, or affect, the scheduling process:

- Schedule requests.
- Responses to schedule requests.
- Schedules.
- Responses to schedules.
- TDRS scheduling windows.
- TDRSS status.
- TDRSS Unscheduled Time.

5.1.4 Scheduling Rules

The scheduling rules constrain the scheduling process in order to ensure that events scheduled by the NCCDS can be supported by the SN. The scheduling rules applicable to the NCCDS are primarily based upon the scheduling ground rules specified in the *Interface Control Document Between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC),* 530-ICD-NCC-FDF/WSC.

5.1.5 Scheduling Process

The scheduling process creates the initial schedule for a given time period and, as needed, updates the initial schedule. The NCCDS requirements for the scheduling process are partitioned into the following areas:

- Scheduling boundaries.
- Batch scheduling.
- Schedule activation.
- Freezing of active schedule events.
- Automatic schedule updates.
- Additional operator capabilities.

5.1.6 Schedule Transmission

Schedule transmission is the process of sending the schedule to the SN elements, the SN customers, and the SN customer support facilities. Conceptually, schedule transmission is a service control rather than a service planning function. However, the NCCDS requirements for schedule transmission are very closely related to the NCCDS requirements for scheduling. For this reason, the detailed schedule transmission requirements are included in Section 5.

5.1.7 Scheduling Displays

The NCCDS requirements for scheduling displays are partitioned into the following areas:

- TDRS scheduling windows.
- Service planning database.
- Schedule requests.
- Scheduled events.
- Printouts.

5.1.8 Event Start/Stop Alerts

The NCCDS alerts the operator at 5 minutes prior to the start of each event and at the scheduled end of each event.

5.1.9 Performance

The NCCDS service planning performance requirements address the following:

- Storage capacity.
- Response to schedule requests.

- Scheduling performance.
- Scheduling effectiveness.
- Schedule transmission rate.
- Routine housekeeping
- TDRSS Unscheduled Time generation and distribution

5.1.10 Backwards Compatibility

NCCDS 1998 must be capable of successful operation in an environment that includes legacy customers who will be unable to upgrade their systems to be compatible with new service planning features to be included in NCCDS 1998. For this reason, NCCDS 1998 must provide complete backwards compatibility.

5.1.11 TDRSS Unscheduled Time

TDRSS Unscheduled Time (TUT) information provides an indication of time periods within the active schedule that are available for the scheduling of additional customer services. The NCCDS will periodically generate TUT information, and then make it available for remote access by customers and for local access by NCC operators.

5.2 Service Planning Database

5.2.1 General

5.2.1.1 Overview

All of the data stored within the NCCDS that pertain to service planning can be regarded as composing the service planning database. Additional requirements for service planning data to be stored within the NCCDS are specified elsewhere in this section. The following paragraphs specify the requirements for the major categories of nondynamic service planning data to be stored within the NCCDS. This data includes the following:

a. Space Network data. This data defines a logical model of the SN which is used by the NCCDS in the scheduling process.

b. Customer data. For each customer, this data defines that customer to the NCCDS and specifies how the customer will use the SN.

c. NCCDS scheduling control data. This data is entered by the operator to control the NCCDS scheduling process.

5.2.1.2 Parameterization

For simplicity, many of the functional and data requirements applicable to service planning are stated in terms of numeric constants. The given values are realistic as of 1999. However, it is

intended that the NCCDS be implemented in a way that will allow these "constants" to be changed without software modification. For example, it is stated that each of the two TDRSS ground terminals contains three SGLTs and that each of the SGLTs can support up to five MAR links. Modification of the NCCDS to make it capable of scheduling different numbers of MAR links per SGLT should be possible via database changes. [Refer to Note 5.2.1.2-1.]

NOTE 5.2.1.2 – 1

The requirement for parameterization applies specifically to the service planning database. In many cases, a service planning database change will not be effective unless a corresponding change is made in one or more additional areas of the system. In some cases, legacy elements of NCCDS 1998 will not be able to easily adapt to such changes. In particular, the Communications and Control Segment (CCS) is limited to five MAR links.

5.2.1.3 Modification Tracking

The NCCDS shall automatically record the date and time of every modification to the service planning database and the identification of the operator responsible for the modification. In all cases, the NCCDS shall include modification tracking information in the displays used to modify the service planning database.

5.2.2 Space Network Data

5.2.2.1 General

The following paragraphs list all SN resources explicitly allocated by the NCCDS in the scheduling process. The NCCDS will provide the operator with the capability to specify the configuration of these resources. For some of these resources, the NCCDS will also provide the operator with the capability to specify the availability (i.e., resource status) of the resource. Additional SN resources not listed in the following paragraphs (e.g., high data rate recorders) may also be involved in the support of SN events. Such resources are configured such that explicit allocation by the NCCDS is unnecessary.

5.2.2.2 TDRSs

Each TDRS is identified by a TDRS identification (ID), a support identification code (SIC), and a TDRS operational name. The TDRS ID is a single alphabetic character permanently assigned to a physical TDRS. TDRS IDs are used in messages exchanged between the NCC and the ground terminals. Each TDRS also has a permanently assigned SIC. The TDRS operational name is a three-character name assigned by network operations and is subject to change. By convention, the TDRS operational name is three numeric characters indicating a TDRS's orbital location in degrees West longitude. The TDRS operational name is used in nearly all displays and in nearly all messages exchanged with the customers. The NCCDS shall provide the operator with the capability to

a. Specify the current physical set of TDRSs in terms of a list of TDRS IDs and associated SICs. Any alphabetic character may be a valid TDRS ID.

b. Specify the current operational set of TDRSs in terms of a list of TDRS operational names. The NCCDS shall have the capacity for at least 15 operational names. [Refer to Notes 5.2.2.2-1, 2.]

NOTE 5.2.2.2 – 1

Unless otherwise specified, "TDRS" as used within this document refers to "TDRS operational name."

NOTE 5.2.2.2 – 2

CCS is limited to 10 TDRS operational names.

c. Enter, modify, and delete the time-ordered TDRS operational name to TDRS ID mappings. For each TDRS operational name and specified time period, these relationships shall indicate whether the TDRS operational name is assigned to a TDRS ID or is not available for customer scheduling.

d. Enter, modify, and delete the time-ordered TDRS operational name to SGLT relationships. For each TDRS operational name and specified time period, these relationships shall indicate whether the TDRS operational name is assigned to an SGLT or is not available for customer scheduling.

e. Specify time intervals during which certain TDRS resources are available for the support of customer services. [Refer to Note 5.2.2.2-3.] The NCCDS shall provide the option to specify such time intervals to be open-ended (i.e., there is no specified end time for the availability interval). For each TDRS ID, the NCCDS shall provide the operator with the capability to specify the availability of the following resources:

1. MAF.
2. MAR.
3. SMAF.
4. SMAR.
5. SA antenna 1.
    (a) SSAF.
    (b) SSAR.
    (c) KuSAF.
    (d) KuSAR.
    (e) KuSAF/KaSAF.
    (f) KuSAR/KaSAR.
6. SA antenna 2.

(a) SSAF.

(b) SSAR.

(c) KuSAF.

(d) KuSAR.

(e) KuSAF/KaSAF.

(f) KuSAR/KaSAR.

NOTE 5.2.2.2 – 3

MAF, MAR, KuSAF, and KuSAR should always be marked as unavailable for TDRS H, I, and J. SMAF, SMAR, KuSAF/KaSAF, and KuSAR/KaSAR should always be marked as unavailable for earlier TDRSs.

f. For each of the above resources for each TDRS ID, the NCCDS shall provide the operator with the capability to specify that any of the schedulable characteristics of the related service are unavailable. [Refer to Note 5.2.2.2-4.] For each resource, the schedulable characteristics of the related service are determined by the valid values of applicable Scheduling Order Data Message (SHO) parameters for the related service type. This includes

1. SHO parameters with discrete lists of valid values (e.g., receiver configuration with valid values "0" and "1"). For such parameters, the NCCDS shall provide the operator with the capability to indicate that use of any specific value is unavailable.
2. SHO parameters with a valid range of numeric values (e.g., data rate). For such parameters, the NCCDS shall provide the operator with the capability to indicate that use of one or more ranges within the normally valid range is unavailable.

NOTE 5.2.2.2 – 4

The GRGT will be configured as the third WSGT SGLT. The GRGT will not provide Shuttle analog support and will provide only local end-to-end test support. These constraints may be accounted for in the NCCDS database via application of the above capability for the TDRS mapped to GRGT.

5.2.2.3 Ground Terminals

The WSC includes two SN ground terminals, the WSGT and the STGT. Each of these two ground terminals includes three SGLTs. The NCCDS shall provide the operator with the capability to

a. Specify the current set of ground terminals. [Refer to Note 5.2.2.3-1.]

NOTE 5.2.2.3 – 1

The CCS is limited to supporting two ground terminals: STGT and WSGT.

b. For each ground terminal, specify the current set of SGLTs.

c. Specify time intervals during which certain SGLT resources are available for the support of customer services. [Refer to Note 5.2.2.3-2.] The NCCDS shall provide the option to specify such time intervals to be open-ended (i.e., there is no specified end time for the availability interval). For each SGLT, the NCCDS shall provide the operator with the capability to specify the availability of the following resources:

   1. Number of MAF/SMAF links.
   2. Number of MAR/SMAR links.
   3. SA antenna 1.
      (a) SSAF.
      (b) SSAR.
      (c) KuSAF/KaSAF.
      (d) KuSAR/KaSAR.
   4. SA antenna 2.
      (a) SSAF.
      (b) SSAR.
      (c) KuSAF/KaSAF.
      (d) KuSAR/KaSAR.
   5. End-to-end test.

NOTE 5.2.2.3 – 2

Some SGLTs will not be capable of supporting TDRS H, I, and J. However, for simplicity the SGLT resources are listed above as if every SGLT will be capable of supporting TDRS H, I, and J. It is assumed that operational procedures will preclude assignment of any of these TDRSs to an SGLT not capable of supporting it.

d. For each SGLT, the NCCDS shall provide the operator with the capability to specify the maximum composite data rate for data flow in the return direction.

e. For each SGLT, the NCCDS shall provide the operator with the capability to specify the maximum composite data rate for data flow in the forward direction.

f. The NCCDS shall provide the operator with the capability to specify a digital data rate for Shuttle video data.

g. For each ground terminal, specify the current set of WDISC PTPs and assign names to them.

1. Each named set may contain up to two PTPs. Thus, a redundant pair of PTPs can be logically associated by the set name. [Refer to Note 5.2.2.3-3.]

NOTE 5.2.2.3 – 3

The PTP set name will be used as a logical destination for schedule transmissions. Refer to paragraph 5.3.4.1.

2. Membership in a PTP set is order dependent. Thus, a set of PTPs contains a first member and a second member as needed.

3. Mapping of a PTP set to a ground terminal is done through the mapping of a PTP set name to a user interface channel, which is mapped to a ground terminal.

5.2.2.4 Effects of Mapping Updates

Refer to the requirements for TDRS operational name to TDRS ID mappings as specified in paragraph 5.2.2.2 c., and for TDRS operational name to SGLT mappings as specified in paragraph 5.2.2.2 d. The NCCDS response to updates to these mappings is to be as follows:

a. Whenever there is any update to these mappings, the NCCDS shall apply the updated mappings to any future processing of schedule requests.

b. Whenever there is any update to these mappings that may affect scheduled events for which schedules have not yet been transmitted, the NCCDS shall alert the operator.

c. Whenever there is any update to these mappings that affects events for which schedules have been transmitted but that have not yet reached their scheduled event start times, the NCCDS shall

   1. Modify the events to use the new mappings.

   2. Verify that all events affected by the mapping updates can be supported without conflict, without use of resources indicated as unavailable, and within the scheduling rules.

   3. For events that can be supported as modified, alert the operator, generate a set of schedule update messages, and provide the operator with the capability to review and transmit these messages.

   4. Alert the operator if there are any events that cannot be supported, and provide the operator with the capability to delete or reschedule these events.

d. Whenever there is any update to these mappings applicable to ongoing events, the NCCDS shall continue to perform all processing for such ongoing events based on the mappings in effect when the schedule messages were transmitted. [Refer to Notes 5.2.2.4-1, 2.]

NOTE 5.2.2.4 – 1

Since the TDRS mappings are time-ordered and since updates to the mappings are generally planned relatively far in the future, mapping updates will only rarely affect ongoing events.

NOTE 5.2.2.4 – 2

The CCS applies the updated mappings to the ongoing events rather than the mappings that had been used for schedule transmission. Operational intervention may be needed to preclude operational anomalies.

5.2.2.5 Multiplexer/Demultiplexer Capacities

The NCCDS shall provide the operator with the capability to specify the values for the maximum bandwidth capacity and fixed overhead for the MDM data system uplink at the ground terminals, GSFC, and JSC. In order to allow for temporary changes in the available capacity of the MDM data system, the NCCDS shall provide the operator with the capability to specify the uplink fixed overheads in a time-ordered manner. [Refer to Notes 5.2.2.5-1, 2, 3.]

NOTE 5.2.2.5 – 1

Physically, there is an MDM at STGT and an MDM at WSGT. However, these are cross-strapped to form a single schedulable WSC MDM system.

NOTE 5.2.2.5 – 2

Uplink from WSC corresponds to data flow in the return direction. Uplink from JSC and GSFC corresponds to data flow in the forward direction.

NOTE 5.2.2.5 – 3

It is assumed that the number of available ports on the MDM systems will always be adequate to support full scheduling of the TDRSS. Therefore, the NCCDS is not required to account for the use of the MDM system on a port-by-port basis.

5.2.2.6 High Data Rate Multiplexer Capacities

The NCCDS shall provide the operator with the capability to specify the value for the maximum bandwidth capacity for the HDRM uplink. [Refer to Notes 5.2.2.6-1, 2.]

NOTE 5.2.2.6 – 1

Physically there is an HDRM at STGT and a HDRM at WSGT. However, these are cross-strapped to form a single schedulable WSC HDRM system.

NOTE 5.2.2.6 – 2

The number of HDRM ports that can be scheduled is limited by the number of HDRM user interface channels. Refer to paragraph 5.2.2.7.2c.

5.2.2.7 User Interface Channels and Port Addresses

5.2.2.7.1 Specification of User Interface Channels

The NCCDS shall provide the operator with the capability to specify a list of user interface channels and pseudo user interface channels. For each user interface channel, the specification is to include:

a. Identifier. [Refer to Note 5.2.2.7.1-1.]

NOTE 5.2.2.7.1 – 1

Current operational conventions implicitly imbed the type, flow direction, and uplink designation of a user interface channel in its identifier. For example, the first character of the identifier indicates the type of user interface channel. It is expected that this practice will continue at least into the beginning of the lifecycle of NCCDS 1998. However in order to allow for greater flexibility in the future, NCCDS 1998 will provides for explicit identification of each user interface channel's type, flow direction, uplink designation, subtype, ground terminal designation, and SDPF support requirement. Full use of this flexibility is not yet possible because some legacy CCS software partly depends on continued use of the operational conventions. In particular, CCS uses the first character of the identifier to distinguish user interface channels mapped to local interface (LI) ports from other types of user interface channels.

b. Type. This indicates whether the user interface channel can be mapped to an MDM port address, an HDRM port, an local interface (LI) port within the LI at WSC, an LI port within the LI at GRGT, an intermediate frequency (IF) port, a WDISC port; or whether the user interface channel is a video user interface channel, an analog user interface channel, or a record-only pseudo user interface channel that is not mapped to any port.

c. Flow direction. For user interface channels whose type allows them to be mapped to MDM port addresses, LI ports or WDISC ports, flow direction indicates either forward or return. For all other types of user interface channels, the flow direction is always return.

d. Uplink designation. For forward user interface channels whose type is MDM, the uplink designation indicates whether the uplink is via the JSC or the GSFC MDM.

e. Subtype. For return LI ports, the subtype indicates whether the port is a low data rate port with a maximum data rate of 10 Mb/sec. or a high data rate port with a minimum data rate above 10 Mb/sec.

f. Ground terminal designation. The ground terminal designation indicates whether the user interface channel is valid for STGT, WSGT, or both. [Refer to Notes 5.2.2.7.1-2 and 5.2.2.7.1-3.]

NOTE 5.2.2.7.1 – 2

User interface channels mapped to GRGT LI ports must be designated as being valid only for WSGT.

NOTE 5.2.2.7.1 - 3

User interface channels mapped to WDISC ports cannot be assigned to both ground terminals.

g. SDPF support. For MDM return, this indicates that SDPF is a recipient of the data.

5.2.2.7.2 Mapping

a. For data flow in the forward direction, the NCCDS shall provide the operator with the capability to specify the one-to-one mapping from MDM user interface channels to MDM port addresses.

b. For low rate digital data flow in the return direction, the NCCDS shall provide the operator with the capability to specify the one-to-one mapping from MDM user interface channels to MDM port addresses. Refer to paragraph 5.4.4.9.2 f.

c. For high rate digital data flow in the return direction, the NCCDS shall provide the operator with the capability to specify the one-to-one-to-one mapping from HDRM user interface channels to HDRM port IDs to HDRM pseudo port addresses. [Refer to Note 5.2.2.7.2-1.]

NOTE 5.2.2.7.2 – 1

The term “HDRM port IDs” has the same meaning as “HDRM port numbers” in 530-ICD-NCC-FDF/WSC. The term “Port ID” is used here to differentiate them from WDISC port numbers, which are referenced later in this document.

d. For video data flow in the return direction, the NCCDS shall provide the operator with the capability to specify the one-to-one mapping from video user interface channels to video pseudo port addresses.

e. For analog data flow in the return direction, the NCCDS shall provide the operator with the capability to specify the one-to-one mapping from analog user interface channels to analog pseudo port addresses.

f. For data flow in the forward direction via LI ports, the NCCDS shall provide the operator with the capability to specify the mapping from forward LI user interface channels to LI port ID. [Refer to Note 5.2.2.7.2-2.]

NOTE 5.2.2.7.2 – 2

Physically, there is a set of LI ports at STGT and a set of LI ports at WSGT. In some cases, an STGT LI port is inter-connected with a WSGT LI port such that scheduling of a particular port at one ground terminal precludes scheduling of the corresponding port at the other ground terminal. In these cases, the ground terminal designator (refer to paragraph 5.2.2.7.1 f) will indicate that the corresponding user interface channel is valid for both ground terminals. In other cases, the STGT and WSGT LI ports are completely independent. In these cases, the ground terminal designator will indicate that the corresponding user interface channel is valid for only one ground terminal. This applies to both forward and return LI ports.

g. For low rate data flow in the return direction via LI ports, the NCCDS shall provide the operator with the capability to specify the mapping from return LI user interface channels to low rate LI port ID (i.e., ports with maximum data rate of 10 Mb/sec.).

h. For high rate data flow in the return direction via LI ports, the NCCDS shall provide the operator with the capability to specify the mapping from return LI user interface channels to high rate LI port ID (i.e., ports with minimum data rate above 10 Mb/sec.).

i. For recording of McMurdo TDRSS Relay System (MTRS) data, the NCCDS shall provide the operator with the capability to specify the mapping from a return LI user interface channel to a dedicated LI port ID. [Refer to Note 5.2.2.7.2-3.]

NOTE 5.2.2.7.2 – 3

Currently LI port zero (0) is dedicated to recording of MTRS data.

j. The NCCDS shall control the above LI user interface channel to LI port ID mappings as follows:

1. Each LI user interface channel is to be mapped to exactly one LI port ID.
2. A specific combination of flow direction and LI port ID is to exist for only one LI user interface channel if that user interface channel applies to both ground terminals.
3. A specific combination of flow direction and LI port ID may exist for two different LI user interface channels if one applies only to STGT and the other applies only to WSGT.

k. For data flow in the return direction via IF ports, the NCCDS shall provide the operator with the capability to specify the mapping from return IF user interface channels to IF port IDs.

l. For data flow in the forward direction via WDISC ports, the NCCDS shall provide the operator with the capability to specify the mapping from forward WDISC user interface channels to WDISC port IDs, pair IDs, and port numbers.

m. For data flow in the return direction via WDISC ports, the NCCDS shall provide the operator with the capability to specify the mapping from return WDISC user interface channels to WDISC port IDs, pair IDs, and port numbers.

n. The NCCDS shall control the above WDISC user interface channel to WDISC port ID mappings as follows:

   1. Each WDISC user interface channel is to be mapped to exactly one WDISC port ID for each ground terminal.

   2. A specific combination of flow direction and WDISC port ID may exist for two different WDISC user interface channels if one applies only to STGT and the other applies only to WSGT.

o. The NCCDS shall provide the operator with the capability to configure WDISC user interface channels in forward and return pairs.

5.2.2.7.3 Use

The NCCDS shall use user interface channels and port addresses as follows:

a. For data flow in the forward direction via the MDM, the MDM user interface channel is directly used in the User Schedule Message (USM) and is used in NES as the source channel ID. The MDM port address is directly used in SHO Subheader #5 and is used in the NES as the destination channel ID, and either “GSFC” or “JSC” (i.e., the uplink designator) is indicated as the data source in SHO Subheader #5.

b. For low rate digital data flow in the return direction via the MDM, the MDM user interface channel is directly used in the USM and is used in the NASA Communications (Nascom) Event Schedule (NES) as the destination channel ID. The MDM port address is directly used in SHO Subheader #6 and is used in the NES as the source channel ID, and “MDM” is indicated as the data destination in SHO Subheader #6.

c. For high rate digital data flow in the return direction via the HDRM, the HDRM user interface channel is directly used in the USM and is used in the NES as the destination channel ID. The HDRM pseudo port address is used in the NES as the source channel ID. The HDRM port number is used in SHO Subheader #6 and “HDRM” is indicated as the data destination in SHO Subheader #6.

d. For video data flow in the return direction, the video user interface channel is directly used in the USM and is used in the NES as the destination channel ID. The video

pseudo port address is used in the NES as the source channel ID. “TV” is indicated as the data destination in SHO Subheader #6.

e. For analog flow in the return direction, the analog user interface channel is directly used in the USM and is used in the NES as the destination channel ID. The analog pseudo port address is used in the NES as the source channel ID. “Analog” is indicated as the data destination in SHO Subheader #6.

f. For record only return data, the record only pseudo user interface channel is used in the USM and “record only” is indicated as the data destination in SHO Subheader #6. No corresponding information is provided to the NEST via an NES message. [Refer to Note 5.2.2.7.3-1.]

NOTE 5.2.2.7.3 – 1

An event that contains a service with the “record only” data destination for one of its channels may contain other services that are to be reported to the NEST via the NES message.

g. For data flow in the forward direction via LI ports, the forward LI user interface channel is used in the USM and the LI port ID is used in SHO Subheader #5, and “LI” is indicated as the data source in SHO Subheader #5. No corresponding information is provided to the NEST via an NES message. . [Refer to Note 5.2.2.7.3-2.]

NOTE 5.2.2.7.3 – 2

Although it is unlikely, an event that contains a service with an LI data source could contain other services that are to be reported to the NEST via the NES message.

h. For data flow in the return direction via LI ports and for recording of MTRS data, the return LI user interface channel is used in the USM and the LI port ID is used in SHO Subheader #6, and “LI” is indicated as the data destination in SHO Subheader #6. No corresponding information is provided to the NEST via an NES message. [Refer to Note 5.2.2.7.3-3.]

NOTE 5.2.2.7.3 –3

Although it is unlikely, an event that contains a service with an LI data destination for one of its channels could contain other services that are to be reported to the NEST via the NES message.

i. For data flow in the return direction via IF ports, the return IF user interface channel is used in the USM and the IF port number is used in SHO Subheader #6, and “IF” is indicated as the data destination in SHO Subheader #6. No corresponding information is provided to the NEST via an NES message. [Refer to Note 5.2.2.7.3-4.]

NOTE 5.2.2.7.3 – 4

An event that contains a service with an IF data destination for one of its channels may contain other services that are to be reported to the NEST via the NES message.

j. For data flow in the forward direction via WDISC ports, the forward WDISC user interface channel is used in the USM. The WDISC port ID is used in SHO Subheader #5, and "LI" is indicated as the data destination in SHO Subheader #5. The forward WDISC UIFC is used in the NES as the source channel ID and the NES destination channel ID is filled with ASCII spaces.

k. For data flow in the return direction via WDISC ports, the return WDISC user interface channel is used in the USM. The WDISC port ID is used in SHO Subheader #6, and "LI" is indicated as the data destination in SHO Subheader #6. The return WDISC UIFC is used in the NES as the destination channel ID and the NES source channel ID is filled with ASCII spaces.

5.2.3 Customer Data

5.2.3.1 General

In order for a customer to receive SN support, certain information for that customer must be established within the NCCDS database. Customer specific information in the NCCDS database includes the following:

- General customer parameters.
- Level of support.
- Service parameter records.
- Service specification codes (SSCs).
- DQM setup parameters.
- Nascom parameters.
- Prototype events.

5.2.3.2 Operator Control of Customer Data

For all of the customer data specified in the following paragraphs, the NCCDS shall provide the operator with the capability to enter, edit, copy, delete, and review the data. In addition to the capability to directly enter new data, the NCCDS shall provide the operator with the capability to create new sets of data by copying and editing existing sets of data.

5.2.3.3 General Customer Parameters

A customer spacecraft is identified by a SIC. All other parameters for a customer spacecraft are related to the spacecraft's SIC. For each SIC, the general customer parameters include the following:

a. Alphanumeric spacecraft name.

b. Vehicle identification code (VIC).

c. Vehicle ID (VID).

d. S-band pseudorandom noise (PN) code and associated PN code library ID.

e. Ku-band/Ka-band PN code and associated PN code library ID. [Refer to Note 5.2.3.3-1.]

NOTE 5.2.3.3 – 1

For normal users, the S-band and Ku-band/Ka-band PN codes are the same. For Shuttle, the S-band PN code applies only to forward services. When two spacecraft are to share the same SA antenna, a "virtual spacecraft" is created in the NCCDS database with the SSA characteristics of one and the Ku/Ka characteristics of the other. In particular, this includes the PN codes. The database for such "virtual spacecraft" should not include any MA/SMA SSCs.

f. Valid service types.

g. Valid support identifiers (SUPIDENs).

h. TDRSs valid for each SUPIDEN.

i. User IDs and associated passwords.

j. Valid user interface channels. This is the list of all user interface channels that may be used in the scheduling of this customer spacecraft. [Refer to Note 5.2.3.3-2.]

NOTE 5.2.3.3 – 2

The same user interface channel may be allocated to more than one customer spacecraft. For instance, this will occur when the same MOC schedules more than one spacecraft.

k. Default flexible event freeze interval which is defined in terms of an interval of time prior to each event's start time.

l. Minimum and maximum TSW durations.

m. Schedule distribution list for fixed USMs, with any of the entries being optionally designated to also receive flexible USMs, and with one of the entries in the list being designated as the customer’s "primary logical destination." [Refer to Notes 5.2.2.2-3, 4.]

NOTE 5.2.3.3 – 3

This list is in terms of "logical destination" names.

NOTE 5.2.3.3 – 4

Each logical destination name must be unique. This will usually require that the logical destination name in some way include identification of the customer. However in some cases, the same logical destination may receive schedules for more than one customer spacecraft.

n. Customer personnel names, phone numbers, and other related customer information including free-text notes.

o. Backwards compatibility requirements. Refer to paragraph 5.10.

p. Minimum gap parameters (optional). Refer to paragraph 5.4.5.1 f.

   1. Minimum gap between SA events.

   2. Minimum gap between MA/SMA events.

   3. Minimum gap between an SA event and an MA/SMA event.

   4. Minimum gap between an MA/SMA event and an SA event.

q. Default wait listed request expiration interval which is defined in terms of an interval of time prior to the requested nominal start time.

5.2.3.4 Level-of-Support

For each customer, the level-of-support parameters specify the amount of each type of service at each customer request priority level (refer to paragraph 5.2.4.1.2) that will normally be provided to the customer. In addition, these parameters specify how the service is to be provided in terms of a distribution across time. For example, the parameters might specify that a customer is to normally receive 140 minutes of SSAF service per week at customer request priority level #2, and that the 140 minutes of SSAF service are to be provided by a minimum of two contacts per day with a minimum of 6 hours between contacts. These parameters are used in the evaluation of schedules (refer to paragraph 5.7.5).

5.2.3.5 Service Parameter Records

The service parameter records define the valid values for each schedulable parameter.

a. For each service type, the NCCDS will provide the operator with the capability to maintain a default service parameter record that specifies the valid values for each schedulable parameter.

b. For each service type for each customer, the service parameter records define how each schedulable parameter is to be validated as the SSCs for that service type and customer are entered into the NCCDS database. For a particular service type for a particular

customer, a service parameter record is needed only when the valid values for at least one of the parameters is different than the default. For a particular parameter for a particular service type for a particular customer, an entry in the service parameter record is needed only when the valid values are different than the default.

c. Playback of data recorded at the ground terminals is to be regarded as a distinct service type with separate service parameters records and SSCs.

5.2.3.6 Service Specification Codes

For each service type to be scheduled, each customer must have at least one SSC specified in the NCCDS database. For each customer, each SSC specifies a set of initial parameter values for the applicable service type. For customers using multiple sets of TSWs, each SSC also identifies the applicable set of TSWs. When an SSC is entered into the database, each parameter is validated according to the applicable service parameter record.

5.2.3.7 Data Quality Monitoring Setup Parameters

For each combination of SIC, data stream ID and data rate, the NCCDS database may contain a set of return-service DQM setup parameters. [Refer to Notes 5.2.3.7-1, 2.] The NCCDS uses the DQM setup parameters in the construction of SHOs and Reconfiguration Request Operations Messages (OPMs) transmitted to the ground terminals. They do not appear in USMs.

NOTE 5.2.3.7 – 1

The ground terminals also perform data quality monitoring for Shuttle forward services. However, the setup information for these services is maintained at the ground terminals rather than being provided by the NCCDS.

NOTE 5.2.3.7 – 2

The data stream ID and data rate parameters applicable to each scheduled service are contained within the SSC used to schedule the service.

5.2.3.8 Nascom Parameters

For each combination of SIC, service type, and data channel, the Nascom parameters specify the settings of certain parameters used in the schedules and reconfiguration messages transmitted to the NEST, to SDPF, and to the ground terminals. These parameters are used for purposes such as configuring the MDM system and do not appear in USMs.

5.2.3.9 Prototype Events

The use of prototype events is optional. However, prototype events can simplify scheduling for customers that repeatedly schedule events with the same structure (i.e., the same set of services with the same durations and relative start times). Each prototype event specifies a set of SSCs with associated service durations, service start time offsets, and service-level flexibility

parameters. The NCCDS shall not permit the entry of any prototype event whose structure violates any of the scheduling ground rules.

5.2.3.10 WDISC Desktops

The NCCDS database contains Desktop mapping and configuration information for customers receiving WDISC support. The NCCDS operator shall have the capability to maintain mappings between SUPIDEN, forward WDISC user interface channel and initial data rate, and/or return WDISC user interface channel and initial data rate, as applicable (i.e., whether or not the desktop utilizes both the forward and return streams).

The NCCDS operator will also have the capability to view some of the related WDISC desktop configuration information. [Refer to Note 5.2.3.10-1.]

NOTE 5.2.3.10 – 1

The desktop configuration information available in the NCCDS database will be a subset of the desktop information maintained on the PTPs and will be available to the NCCDS for troubleshooting purposes only.

5.2.3.11 Password Management

As stated in paragraph 5.2.3.3, the NCCDS will provide the operator with the capability to specify the valid user IDs and associated passwords for each customer SIC. The following additional requirements apply to the management of passwords:

a. The NCCDS shall be capable of managing at least two different password values for each user ID.

b. For each User ID, the NCCDS shall accept all of its passwords in the validation of incoming messages.

c. The NCCDS shall allow the operator to change any password at any time, and shall record the time at which each change occurs.

d. For each User ID, the NCCDS shall allow the operator to review the current passwords and when they were most recently changed.

e. For each User ID, the NCCDS shall permit the operator to enter the same value for all of the passwords or to reduce the number of passwords to one. [Refer to Notes 5.2.3.11-1, 2.]

NOTE 5.2.3.11 – 1

The mechanism specified above allows the operator to manually control the transition from the use of one password to another without requiring the customer to perform the transition at exactly the same time. It is intended that all of passwords for a User ID will have the same value except during these transitions.

NOTE 5.2.3.11 – 2

CCS does not directly support the capability to have multiple passwords per user ID per SIC. Therefore the transition from the active use of one password to another must occur when real-time support is not needed.

5.2.4 NCCDS Scheduling Control Data

5.2.4.1 Scheduling Priorities

5.2.4.1.1 Mission Priorities

The NCCDS shall contain a mission priorities list based on priorities established by NASA management. The NCCDS shall provide the operator with the capability to

a. Review the list.

b. Update the list whenever customer spacecraft are added or deleted.

c. Rearrange the list.

5.2.4.1.2 Customer Request Priority Levels

Each SAR specifies a customer request priority level. The customer request priority level allows different requests from the same customer to be given different priorities.

5.2.4.1.3 Scheduling Priorities Lists

The NCCDS shall contain one or more scheduling priorities lists that reflect both the NASA-assigned mission priorities and the customer request priority levels. The NCCDS strategy for the resolution of scheduling conflicts is partially defined by the scheduling priorities list. At any time, the number of entries in the list is the number of valid customer spacecraft identified in the mission priorities list multiplied by the number of customer request priority levels. The default order for the scheduling priorities list is the equivalent of first sorting the list by customer request priority level and then sorting it according to the mission priorities list. [Refer to Note 5.2.4.1.3-1.] The NCCDS shall provide the operator with the capability to

a. Manage multiple priority lists.

b. Update the lists whenever the mission priorities list is modified.

c. Review the lists.

d. Rearrange any list.

e. Restore any list to the default order.

f. Select any list to be the currently active list.

NOTE 5.2.4.1.3 – 1

Example: If there are 100 spacecraft and 3 customer request priority levels, the total number of entries in the list is 300. The second overall entry is the highest customer request priority level for the second highest priority mission and the 101st overall entry is the second highest customer request priority level for the highest priority mission.

5.2.4.2 TDRS Sets

A TDRS operational name (refer to paragraph 5.2.2.2) may be any three alphanumeric characters. The TDRS parameter within a schedule request may refer to a single TDRS, all TDRSs, or a subset of TDRSs. If one of the designated TDRS operational names is used (refer to paragraph 5.2.2.2b), a single TDRS is specified. The NCCDS shall provide the operator with the capability to define TDRS sets and assign names to them. A TDRS set may include TDRS operational names or other TDRS set names. For example:

a. A TDRS set named "ALL" could include all TDRSs. When used in a SAR, "ALL" would then indicate that the customer will accept support on any TDRS.

b. A TDRS set named "TDW" could include the TDRS at 171° and the TDRS at 174°. When used in a SAR, "TDW" would then indicate that the customer will accept support on either the TDRS at 171° or the TDRS at 174°.

c. TDRS sets named 'TW1" and 'TW2' could each include the TDRS at 171, and be used as aliases for 171. TDRS sets named 'TW3' and 'TW4' could each include the TDRS at 174, and be used as aliases for 174. A TDRS set named 'TDW' could include 'TW1', 'TW2', 'TW3', and 'TW4'. When used in a SAR, 'TDW' would then indicate that the customer will accept support on either 'TW1' or 'TW2' (i.e., the aliases for the TDRS at 171), or 'TW3' or 'TW4' (i.e., the aliases for the TDRS at 174). This is similar to the previous example, but the TDRS aliases provide the customer with increased flexibility in how TSWs are specified. Refer to paragraph 5.3.6.2 b.

5.2.4.3 Boundary Between SAR Batch Scheduling and SAR Automatic Scheduling Update Subphases

5.2.4.3.1 General

The NCCDS shall maintain the boundary between the SAR batch scheduling and SAR automatic scheduling update subphases. At any time, the current boundary is determined by the relationship of an absolute boundary and a relative boundary. SARs that apply to times further in the future than the current boundary will be processed via batch scheduling. SARs that apply to times between the current time and the current boundary will be automatically processed.

5.2.4.3.2 Absolute Boundary

The NCCDS shall provide the operator with the capability to specify an absolute time (i.e., a specific future date and time of day) to be used as the boundary between the SAR batch scheduling and SAR automatic scheduling update subphases.

5.2.4.3.3 Relative Boundary

The NCCDS shall provide the operator with the capability to specify a relative interval and one or more times of day at which the relative boundary is to be reset. When such reset occurs, the relative boundary is equal to the current time plus the relative interval.

5.2.4.3.4 Current Boundary

The NCCDS shall determine the current boundary between the SAR batch scheduling and SAR automatic scheduling updates subphases as follows:

a. The absolute boundary is used as the current boundary when:

   1. It is earlier than the end of the active period, and the end of the active period is earlier than or equal to the relative boundary.

   2. It is earlier than the end of the active period and later than or equal to the relative boundary.

b. The relative boundary is used as the current boundary when:

   1. It is earlier than the end of the active period, and the end of the active period is earlier than or equal to the absolute boundary (if any).

   2. It is earlier than the end of the active period and later than the absolute boundary (if any).

c. The end of the active period is used as the current boundary when neither the relative boundary nor the absolute boundary (if any) is earlier than it. [Refer to Note 5.2.4.4.4-1.]

NOTE 5.2.4.4.4 – 1

The end of the active period is defined as the event start time that lies furthest in the future of all events that have been activated by the operator.

5.2.4.3.5 Reset of the Relative Boundary

When a specified time of day for reset of the relative boundary is reached, the NCCDS shall determine whether the relative boundary is, or is about to become, the current boundary.

a. If the relative boundary is not the current boundary and reset of the relative boundary would not make it become the current boundary, the NCCDS shall reset the relative boundary to be equal to the current time plus the relative interval.

b. If the relative boundary is the current boundary or if its reset would make it become the current boundary, the NCCDS shall alert the operator and then provide the operator with three options:

   1. Allow the reset to proceed.

   2. Enter a new absolute boundary and then allow the reset to proceed.

   3. Postpone the reset. In this case, the NCCDS shall reprompt the operator in one hour.

5.2.4.4 Automatic Schedule Update Alert Period

The NCCDS shall provide the operator with the capability to specify a period during which any automatic update to the schedule will result in an alert. The period is to be specified relative to the current time. For example, if the specified period is 7 hours, then any automatic updates to the schedule applicable to times less than 7 hours in the future will result in alerts.

5.2.4.5 Customer Request Reception Alert Period

a. The NCCDS shall provide the operator with the capability to specify a period during which the receipt of any schedule request queued for batch scheduling will result in an alert. The period is to be specified relative to the current time. [Refer to Note 5.2.4.6-1.]

NOTE 5.2.4.6 – 1

This capability is primarily intended to be used when the operator has severely shortened the SAR automatic scheduling update subphase, and new requests queued for batch scheduling may need immediate attention.

b. The NCCDS shall provide the operator with the capability to specify a period during which the receipt of any customer schedule request queued for automatic scheduling during periods of automatic scheduling lockout will result in an alert. The period is to be specified relative to the current time.

5.2.4.6 Retention of Time-Dependent Data

5.2.4.6.1 General

The NCCDS shall retain time-dependent service planning data at least until it is too old for operational use. After that time, the NCCDS may purge this data. Purged data is no longer available for use in scheduling, but is retained for use in applicable service accounting functions. Time-dependent service planning data includes the following:

- Schedule requests.
- Schedules.
- TSWs.

5.2.4.6.2 Operator Control

The NCCDS shall provide the operator with the capability to specify the following parameters:

a. The retention criteria for schedule requests. Nominally, the NCCDS will retain schedule requests for at least 72 hours after the requested event start time of the request.

b. The retention criteria for scheduled events and associated schedule messages. Nominally, the NCCDS will retain scheduled events and associated schedule messages for at least 48 hours after event start time.

c. The retention criteria for TSWs. Nominally, the NCCDS will retain TSWs for at least 24 hours after the window closing time of the TSW.

5.2.4.7 SA Antenna Slew Time

The NCCDS shall provide the operator with the capability to specify the SA antenna slew time. Refer to paragraph 5.4.5.3.2.

5.3 Schedule Messages

5.3.1 General

The following seven categories of messages are used in, or affect, the scheduling process:

- Schedule requests.
- Responses to schedule requests.
- Schedules.
- Responses to schedules.
- TDRS scheduling windows.
- TDRSS status.

5.3.2 Schedule Requests

5.3.2.1 General

The NCCDS shall have the capability to receive schedule requests via formatted messages transmitted by the customers and by the ground terminals, and directly from the NCC operators. The NCCDS shall retain all schedule requests, and shall provide the NCC operator with the capability to review and edit all schedule requests.

5.3.2.2 Customer Schedule Requests

5.3.2.2.1 General

The NCCDS will receive the following types of schedule requests from customers via formatted messages:

- SAR.
- Alternate SAR.
- Replace Request.
- Wait List Request.
- Delete Request.
- Schedule Result Request.

5.3.2.2.2 Identification of Customer Requests

Every formatted message has a message ID. The NCCDS shall use the message ID of a SAR, Alternate SAR, or Replace Request as the basis for creating identifiers included in all related messages subsequently transmitted to the logical destinations specified for the customer. In addition, the NCCDS shall be capable of using identifiers provided by customers in subsequent requests to relate these requests to earlier requests. For example, an Alternate SAR references a previously submitted schedule request.

5.3.2.2.3 Validation of Customer Requests

The following validation criteria apply to all customer schedule requests. Additional validation criteria applicable to specific types of customer schedule requests are specified in later paragraphs.

a. Authorized requesters. The NCCDS shall verify that the User ID and password of the request are valid for the request's SIC or SICs. If the User ID and password are not valid, the NCCDS shall alert the operator.

b. SUPIDEN. The NCCDS shall validate that each SUPIDEN specified in the request is valid for the SUPIDEN’s SIC.

5.3.2.2.4 Schedule Add Request

5.3.2.2.4.1 General

The SAR provides the customer with the capability to request that a specified event be placed on the SN schedule. In addition, the SAR provides the customer with the capability to specify that it is to be placed on the wait list if its initial processing is unsuccessful and the SAR applies to the

active period. In general, the NCCDS will attempt to add an event to the schedule in response to a valid SAR. Upon receipt of a customer SAR, the NCCDS shall determine whether the SAR is valid.

5.3.2.2.4.2 Validation of Schedule Add Requests

In addition to the general validation requirements specified in paragraph 5.3.2.2.3, the NCCDS shall reject any SAR that fails any of the following checks:

a. The SAR must have valid syntax.

b. The SAR must specify an event start time range that includes times less than 28 days in the future and that includes times more than an operator-specified interval into the future. The NCCDS shall provide the operator with the capability to specify this interval. It is expected that this interval will usually be set between 5 and 10 minutes.

c. The SAR must either directly specify a TDRS allowed for the specified SUPIDEN, or must specify a TDRS set that contains at least one TDRS allowed for the specified SUPIDEN.

d. The SAR must reference either a prototype event defined for the specified customer spacecraft or one or more SSCs defined for the specified customer spacecraft.

e. The SAR must specify at least 1 and at most 16 services; however, any SSAR combining service is to be counted as two services. In an end-to-end test event, the end-to-end test data sets and the normal forward and return traffic services are each counted as a separate service.

f. The SAR must respecify only respecifiable parameters.

g. For each parameter, the SAR must specify only values within the range permitted for that parameter.

h. The SAR must require an event duration of at most 24 hours.

i. The SAR must require that all service durations be at least 1 minute.

j. The nominal structure of the SAR (i.e., the structure prior to application of service-level flexibility parameters) must specify at least one service at all times during the event.

k. The SAR must not require violation of any of the scheduling rules specified in paragraph 5.4.

5.3.2.2.4.3 Invalid Schedule Add Requests

If an incoming SAR for an authorized requester is invalid, the NCCDS shall

a. Transmit a Schedule Result Message (SRM) to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request. The SRM is to indicate the reason for rejection.

b. Alert the operator.

5.3.2.2.4.4 Valid Schedule Add Requests

If an incoming SAR is valid, the NCCDS shall

a. Determine TSW availability. If a SAR specifies that TSWs are to be used, the NCCDS shall determine whether the required TSWs are available within the NCCDS and whether the timespan for each of the services specified by the SAR can fit within its specified TSW.

b. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request. If the SAR itself is valid but usable TSWs are not available, this shall be indicated in the SRM.

c. Determine whether the SAR applies to the SAR batch scheduling subphase or to the SAR automatic update scheduling subphase.

   1. If the SAR applies to the SAR batch scheduling subphase, the NCCDS shall store the SAR for batch scheduling as specified in paragraph 5.5.3.

   2. If the request applies to the SAR batch scheduling subphase and is received during the customer request reception alert period (refer to paragraph 5.2.4.6), the NCCDS shall alert the operator.

   3. If the SAR applies to the SAR automatic update scheduling subphase, the NCCDS shall process the SAR as specified in paragraph 5.5.6.

5.3.2.2.5 Alternate Schedule Add Request

5.3.2.2.5.1 General

The Alternate SAR provides the customer with the capability to request that a specified event be placed on the SN schedule contingent upon the NCCDS failing to place some other specified event on the SN schedule. In general, the NCCDS will attempt to schedule an event in response to an Alternate SAR only after all possibilities for scheduling an event in response to the request referenced by the Alternate SAR have been exhausted. An Alternate SAR must reference a SAR, a Replace Request, or another Alternate SAR that has either been declined or is currently stored for batch scheduling. [Refer to Note 5.3.2.2.5.1-1.] Since an Alternate SAR can point to another Alternate SAR, it is possible to form a chain of Alternate SARs. Upon receipt of a customer Alternate SAR, the NCCDS shall determine whether the Alternate SAR is valid

NOTE 5.3.2.2.5.1 – 1

Alternate SARs that would be valid if received before batch scheduling begins or after it completes may be rejected if received while batch scheduling is in progress. This can occur if the Alternate SAR references a chain of requests that is declined when the batch schedule is activated. In all cases, the NCCDS will provide appropriate SRMs to the MOC.

5.3.2.2.5.2 Validation of Alternate Schedule Add Requests

In addition to the general validation requirements specified in paragraph 5.3.2.2.3 and the SAR validation requirements specified in paragraph 5.3.2.2.4.2, the NCCDS shall reject any Alternate SAR that does not reference a SAR, a Replace Request, or another Alternate SAR that has either been declined or is currently stored for batch scheduling. In addition, the NCCDS shall reject any Alternate SAR that references a declined request that is a member of a chain of requests that has already yielded an event on the active schedule.

5.3.2.2.5.3 Invalid Alternate Schedule Add Requests

If an incoming Alternate SAR for an authorized requester is invalid, the NCCDS shall

a. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

b. Alert the operator.

5.3.2.2.5.4 Valid Alternate Schedule Add Requests

If an incoming Alternate SAR is valid, the NCCDS shall

a. Determine TSW availability. If an Alternate SAR specifies that TSWs are to be used, the NCCDS shall determine whether the required TSWs are available within the NCCDS and whether the timespan for each of the services specified by the Alternate SAR can fit within its specified TSW.

b. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request. If the Alternate SAR itself is valid but usable TSWs are not available, this shall be indicated in the SRM.

c. Store the Alternate SAR such that it is logically linked to its referenced request. If there is a chain of schedule requests and a new Alternate SAR is linked to any request other than the last request in the chain, the chain is broken. If the process of linking a new Alternate SAR breaks an existing chain, the NCCDS shall

    1. Delete each request in the broken segment of the chain.

2. For each deleted request, transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

3. For any deleted request that has resulted in event(s) being placed in batch schedule(s) that have not been activated, remove the event(s) from the batch schedule(s) and alert the operator.

d. If the referenced request has been declined and all other requests in an associated chain of requests (if any) have also been declined, the NCCDS shall process the Alternate SAR as if it were a SAR. The requirements of paragraph 5.3.2.2.4.4c apply.

e. If the request is received during the customer request reception alert period (refer to paragraph 5.2.4.6), the NCCDS shall alert the operator.

5.3.2.2.6 Replace Request

5.3.2.2.6.1 General

The Replace Request provides the customer with the capability either to replace a scheduled event with another event, or to replace a SAR, an Alternate SAR, or another Replace Request that has either been declined or is currently stored for batch scheduling. In addition, the Replace Request provides the customer with the capability to specify that it is to be placed on the wait list if its initial processing is unsuccessful and the Replace Request applies to the active period and it references either an active event, the first member of a chain of requests, or a request that is not a member of a chain. In general, the NCCDS's handling of a Replace Request depends upon what the Replace Request attempts to replace. For example, if a Replace Request replaces an Alternate SAR, the Replace Request is handled as if it were an Alternate SAR. The NCCDS will attempt to schedule an event in response to such a Replace Request only after all possibilities for scheduling an event in response to the request referenced by the replaced Alternate SAR have been exhausted. In contrast, if a Replace Request references an event on the active schedule, the NCCDS will immediately attempt to replace the event with the event specified by the Replace Request. Upon receipt of a customer Replace Request, the NCCDS shall determine whether the Replace Request is valid.

5.3.2.2.6.2 Validation of Replace Requests

In addition to the general validation requirements specified in paragraph 5.3.2.2.3 and the SAR validation requirements specified in paragraph 5.3.2.2.4.2, the NCCDS shall reject any Replace Request that does not reference a scheduled event, or a SAR, an Alternate SAR, or another Replace Request that has either been declined or is currently stored for batch scheduling. In addition, the NCCDS shall reject any Replace Request that references a declined request that is a member of a chain of requests that has already yielded an event on the active schedule.

5.3.2.2.6.3 Invalid Replace Requests

If an incoming Replace Request for an authorized requester is invalid, the NCCDS shall

a. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

b. Alert the operator.

5.3.2.2.6.4 Valid Replace Requests

If an incoming Replace Request is valid, the NCCDS shall

a. Determine TSW availability. If a Replace Request specifies that TSWs are to be used, the NCCDS shall determine whether the required TSWs are available within the NCCDS and whether the timespan for each of the services specified by the Replace Request can fit within its specified TSW.

b. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request. If the Replace Request itself is valid but usable TSWs are not available, this shall be indicated in the SRM.

c. Determine the applicability of the Replace Request, and perform all of the following that are applicable. Possible combinations are: 1, 2, 2 and 3, and 4.

    1. If the Replace Request applies to an event during the active scheduling period, the NCCDS shall process the Replace Request as specified in paragraph 5.5.6.

    2. If the Replace Request applies to a request currently stored for batch scheduling, the NCCDS shall replace the previously stored request with the Replace Request. If the replaced request was a member of a chain of schedule requests, the NCCDS shall store the new Replace Request such that all logical linkages to or from the replaced request now apply to the new Replace Request. If the request applies to a request currently stored for batch scheduling and is received during the customer request reception alert period (refer to paragraph 5.2.4.6), the NCCDS shall alert the operator.

    3. If the Replace Request applies to a request currently stored for batch scheduling and that request has resulted in an event(s) being placed in a batch schedule(s) that has not been activated, the NCCDS shall remove the event(s) from the batch schedule(s) and alert the operator.

    4. If the referenced request has been declined and all other requests in an associated chain of requests (if any) have also been declined, the NCCDS shall process the Replace Request as if it were a SAR. The requirements of paragraph 5.3.2.2.4.4c apply.

5.3.2.2.7 Wait List Request

5.3.2.2.7.1 General

The Wait List Request provides the customer with the capability to specify that a declined schedule request is to be included in future wait list processing which automatically attempts to schedule such declined requests whenever resources become available during the active period. (Refer to paragraph 5.5.6.7.)

5.3.2.2.7.2 Validation of Wait List Requests

In addition to the general validation requirements specified in paragraph 5.3.2.2.3, the NCCDS shall reject any Wait List Request that does not reference a request that has been reported to the customer as declined via an SRM. In addition, if the referenced request is a member of a chain of requests formed by use of Alternate SARs, the NCCDS shall reject the Wait List Request if any of the following conditions are true:

a. The referenced request is not the first member of the chain.

b. The chain has already been placed on the Wait List.

c. Any member of the chain has not been declined.

d. Any member of the chain has resulted in an event being placed on the active schedule.

5.3.2.2.7.3 Invalid Wait List Requests

If an incoming Wait List Request for an authorized requester is invalid, the NCCDS shall

a. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

b. Alert the operator.

5.3.2.2.7.4 Valid Wait List Requests

If an incoming Wait List Request is valid, it refers to a request that has been reported to the customer as declined via an SRM. The handling varies depending upon whether the referenced request is a member of a chain of requests formed by use of Alternate SARs.

a. If the Wait List Request refers to a request that is the first member of a chain of requests, the NCCDS shall include all members of the chain in future wait list processing. The NCCDS shall preserve the linkage among the members of the chain.

b. If the Wait List Request refers to a request that is not a member of a chain of requests, the NCCDS shall include the individual request in future wait list processing.

c. In all cases, whenever a declined request is to be included in future wait list processing, the NCCDS shall report this to the customer with an SRM.

5.3.2.2.8 Delete Request

5.3.2.2.8.1 General

The Delete Request provides the customer with the capability either to delete a scheduled event, or to cancel a SAR, an Alternate SAR, or a Replace Request currently stored for batch scheduling. In general, the NCCDS will immediately delete the referenced event or cancel the referenced request. Upon receipt of a customer Delete Request, the NCCDS shall determine whether the Delete Request is valid.

5.3.2.2.8.2 Validation of Delete Requests

In addition to the general validation requirements specified in paragraph 5.3.2.2.3, the NCCDS shall reject any Delete Request that does not reference an event, or a SAR, an Alternate SAR, or a Replace Request that is currently stored for batch scheduling or wait list processing.

5.3.2.2.8.3 Invalid Delete Requests

If an incoming Delete Request for an authorized requester is invalid, the NCCDS shall

a. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

b. Alert the operator.

5.3.2.2.8.4 Valid Delete Requests

If an incoming Delete Request is valid, the NCCDS shall determine the applicability of the Delete Request, and perform all of the following that are applicable. Possible combinations are: a, b, and b and c.

a. If the Delete Request applies to an event during the active scheduling period, the NCCDS shall process the Delete Request as specified in paragraph 5.5.6.

b. If the Delete Request applies to a request currently stored for batch scheduling or wait list processing, the NCCDS shall delete the previously stored request and transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request. If the deleted request was a member of a chain of prime/alternate schedule requests and was not the last request in the chain, the chain is broken. If the process of deleting a batched request breaks an existing chain, the NCCDS shall

    1. Delete each request in the broken segment of the chain.

    2. For each deleted request, transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

c. If the Delete Request applies to a request currently stored for batch scheduling or wait list processing and that request has resulted in an event being placed in a batch schedule that has not been activated, the NCCDS shall remove the event from the batch schedule and alert the operator.

5.3.2.2.9 Schedule Result Request

5.3.2.2.9.1 General

The Schedule Result Request (SRR) provides the customer with the capability to specify a logical destination and a list of SUPIDENs. The NCCDS applies the specified logical destination to a newly established external communications connection for the purpose of transmitting SRMs and USMs for the SUPIDENs listed in the SRR. [Refer to Note 5.3.2.2.9.1-1.]

NOTE 5.3.2.2.9.1 – 1

Refer to paragraph 9.4.2. For legacy customers continuing to use Nascom 4800 bits/block protocols, the NCCDS will internally generate SRRs.

5.3.2.2.9.2 Validation of Schedule Result Requests

In addition to the general validation requirements specified in paragraph 5.3.2.2.3, the NCCDS shall reject any SRR if it is not the first message received on a newly established external communications connection or if it contains a SUPIDEN that is not valid for the specified logical destination. [Refer to Note 5.3.2.2.9.2-1.]

NOTE 5.3.2.2.9.2 – 1

A customer may establish multiple communications connections on which SRRs have specified the same logical destination. However if such SRRs have specified overlapping lists of SUPIDENs, the routing specification for these SUPIDENs is ambiguous. The NCCDS may route the SRMs and USMs for these SUPIDENs on any of the communications connections for the specified logical destination.

5.3.2.2.9.3 Invalid Schedule Result Requests

If an incoming SRR is invalid, the NCCDS shall

a. Alert the operator.

b. Break the communications connection.

5.3.2.2.9.4 Valid Schedule Result Requests

The NCCDS shall use the information specified by SRR messages as the basis for the routing of all SRMs and USMs.

5.3.2.3 Ground Terminal Schedule Requests

5.3.2.3.1 General

The NCCDS will receive the following types of schedule requests from the ground terminals via formatted messages:

- TDRS Maneuver Request.
- Preventive Maintenance Request.

5.3.2.3.2 TDRS Maneuver Request

The TDRS Maneuver Request provides the ground terminals with the capability to request permission to initiate a TDRS maneuver. The TDRS Maneuver Request is a free-text message. General requirements applicable to free-text messages are specified in paragraph 6.6. There is no automatic processing of the content of the message; however, the operator may specify a TDRS as unavailable (refer to paragraph 5.2.2.2), thereby preventing the allocation of customer services to a TDRS while it is maneuvering.

5.3.2.3.3 Preventive Maintenance Request

The PM Request provides the ground terminals with the capability to request permission to schedule preventive maintenance. The PM Request is a free-text message. General requirements applicable to free-text messages are specified in paragraph 6.6. There is no automatic processing of the content of the message; however, the operator may specify ground terminal resources as unavailable (refer to paragraph 5.2.2.3), thereby preventing the allocation of customer services to resources undergoing PM.

5.3.2.4 Operator Requests

For all types of schedule requests, other than the SRR, that may be received via formatted message, the NCCDS shall provide the operator with an equivalent capability. In addition, the NCCDS will provide the operator with capabilities not available via formatted message. Refer to paragraph 5.5.7.

5.3.3 Responses to Schedule Requests

5.3.3.1 Schedule Result Message

The SRM is used by the NCCDS to report to the customer actions taken by the NCCDS and the NCC operators in response to customer requests and on scheduled events. The set of actions reported by the NCCDS in SRMs shall include the following:

a. Request fails validation.

b. Valid request is queued for processing. Such SRMs shall also indicate one of the following

1. Use of TSWs has not been requested.
2. Use of TSWs has been requested, but applicable TSWs are not available.
3. Use of TSWs has been requested, applicable TSWs are available, but request cannot be scheduled within these TSWs.
4. Use of TSWs has been requested, applicable TSWs are available, and request can be scheduled within these TSWs.

c. A request is declined (i.e., the system has unsuccessfully attempted to place an event on the schedule in response to the request and any further attempts will require either customer or operator intervention).

d. Request is placed on wait list.

e. Request is removed from wait list without having been scheduled.

f. Event is added to schedule. Such SRMs shall also indicate one of the following

1. Event is based on a request submitted by the customer.
2. Event is based on a request submitted by the customer, but which has been edited by an NCC operator.

g. A USM is transmitted for an event that does not fit within the newest available applicable TSWs.

h. Event is deleted from the schedule. [Refer to Note 5.3.3.1-1.] Such SRMs shall also indicate one of the following

1. Event is deleted in response to NCC operator action.
2. Event is deleted in direct response to customer request.
3. Event is deleted in response to successful wait list processing of a higher ranking member of the same chain of requests.

NOTE 5.3.3.1– 1

When an event is deleted from the schedule, SRMs are transmitted to all destinations that have received USMs. For example, refer to paragraph 5.5.6.6. All other SRMs are transmitted only to the customer's primary logical destination.

5.3.3.2 TDRS Maneuver Approval

The NCCDS provides the operator with the capability to create and transmit a TDRS Maneuver Approval message to the WSGT or to the STGT. As an option, the NCCDS provides the operator with the capability to create the TDRS Maneuver Approval message by copying and editing a previously received TDRS Maneuver Request message or a previously transmitted TDRS Maneuver Approval message. These capabilities are provided via the general requirements applicable to free-text messages as specified in paragraph 6.6. In addition, the NCCDS shall

provide the operator with the capability to record information about TDRS maneuvers in the database.

5.3.4 Schedules

5.3.4.1 General

The NCCDS transmits schedules in several different formats. Each format is designed to carry the specific information needed by the systems and facilities at its specified destination. For each destination, there may be variations on the schedule message based on when the message is transmitted and the types of services included in the message. [Refer to Notes 5.3.4.1-1 and 5.3.4.1-2.]

NOTE 5.3.4.1– 1

With regard to messages formatted and transmitted by the NCCDS, this document uses "destination" to refer to the message header parameter that specifies where a message is to be sent. The exact names (e.g., "destination code", "destination IP address") of these parameters vary depending upon the protocol applicable to particular messages. Refer to the applicable interface control documents (ICDs) for specific details.

NOTE 5.3.4.1– 2

The Programmable Telemetry Processors (PTPs) at each ground terminal are referenced through PTP set names, which are regarded as scheduling destinations. Refer to Section 5.2.2.3.

5.3.4.2 User Schedule Message

5.3.4.2.1 General

USMs are transmitted to Mission Operations Centers (MOCs) and other customer facilities. A USM may specify either a flexible event or a fixed event. If an event is deleted after a USM has been transmitted, the NCCDS will transmit an SRM. The NCCDS shall use the following variations of the USM as indicated:

a. Premium support. The premium support fixed-event USM (type 94 class 02) is used for events scheduled less than 45 minutes prior to event start time. There is no premium support flexible-event USM.

b. Simulation support. The simulation support USM is used for events containing end-to-end test services. Simulation support USMs may be used either for fixed events (type 94 class 03) or for flexible events (type 94 class 05). [Refer to Note 5.3.4.2.1-1.]

NOTE 5.3.4.2.1– 1

When a USM applies to an event that is scheduled less than 45 minutes prior to event start time and that also contains end-to-end test services, the NCCDS will generate a simulation support USM.

c. Normal support. The normal support USM is used for all other events. Normal support USMs may be used either for fixed events (type 94 class 01) or for flexible events (type 94 class 04).

5.3.4.2.2 Event Identification

Within the interface between the NCCDS and any individual customer, the NCCDS shall provide a unique identification of each event. For events scheduled in response to schedule requests submitted by the customer, the NCCDS shall base the message ID of the USM on the message ID of the schedule request. The USM's message ID then serves as the event ID. (Refer to paragraph 5.3.2.2.2.) For events scheduled in response to operator inputs, the NCCDS shall create USM message IDs that uniquely identify such events and that do not conflict with the identification of events scheduled in response to SARs.

5.3.4.2.3 Flexible User Schedule Messages

Special considerations apply to the information conveyed in flexible parameters within flexible USMs.

a. Resource parameters. If the schedule request indicated flexibility for a particular resource, the NCCDS is to fill in the corresponding parameter in the flexible USM as follows:

1. TDRS. If the request specified a TDRS set rather than a specific TDRS, the NCCDS shall indicate a specific TDRS in the corresponding flexible USM parameter. However, this indication should not be interpreted as precluding the selection of another TDRS when the event is frozen and a fixed USM is transmitted.

2. SA Antenna. If the request specified SA antenna flexibility, the NCCDS shall indicate a specific SA antenna in the corresponding flexible USM parameter. However, this indication should not be interpreted as precluding the selection of another SA antenna when the event is frozen and a fixed USM is transmitted.

3. MAR and SMAR Link ID. In all cases, the NCCDS shall fill MAR and SMAR Link ID parameters with ASCII spaces in flexible USMs.

4. User Interface Channel ID. If the request specified User Interface Channel flexibility (i.e., the referenced SSC provided a list of User Interface Channel IDs rather than an individual User Interface Channel ID), the NCCDS shall indicate a specific User Interface Channel ID in the corresponding flexible USM parameter. However, this indication should not be interpreted as precluding the selection of a

different User Interface Channel ID when the event is frozen and a fixed USM is transmitted.

b. Time-related parameters. If the schedule request indicated any flexibility for a particular time-related parameter, the NCCDS shall use the corresponding parameter in the flexible USM to specify an estimation of the value that that parameter would have had if the event had been frozen at the time of the schedule transmission. Also refer to paragraph 5.4.7.5.

5.3.4.3 Scheduling Order Data Message

SHOs are transmitted to the ground terminals. Each SHO specifies a fixed event. If an event is deleted after a SHO has been transmitted, the NCCDS will transmit a Cancel SHO Request OPM. The NCCDS shall use the following variations of the SHO as indicated:

a. Periodic SHO. Periodic SHOs (type 08) are used for events transmitted equal to or greater than 2 hours prior to event start time. [Refer to Note 5.3.4.3-1.]

NOTE 5.3.4.3 – 1

Normally, periodic SHOs are not transmitted earlier than 48 hours prior to event start time. This is controlled by operations procedures.

1. Interfacility link (IFL) SHO. The IFL SHO (class 06) is transmitted to WSGT for high-data-rate return services supported by STGT.

2. End-to-end test SHO. The end-to-end test SHO (class 03) is used for events containing end-to-end test services. [Refer to Note 5.3.4.3-2.]

NOTE 5.3.4.3 – 2

For the purposes of accounting for the number of services in a SHO, STGT and WSGT regard an end-to-end test service and its associated forward or return service as a single service.

3. Normal SHO. The normal SHO (class 01) is used for all other events.

b. Routine SHO. Routine SHOs (type 02) are used for events transmitted at least 5 minutes and less than 2 hours prior to event start time.

1. IFL SHO. The IFL SHO (class 06) is transmitted to WSGT for high-data-rate return services supported by STGT.

2. End-to-end test SHO. The end-to-end test SHO (class 03) is used for events containing end-to-end test services.

3. Normal SHO. The normal SHO (class 01) is used for all other events.

5.3.4.4 Nascom Event Schedule

The NES is transmitted to the NEST. A variation of the NES is also transmitted to customer support facilities such as the SDPF. Each NES specifies a fixed event. If an event is deleted after an NES has been transmitted, the NCCDS will transmit a Nascom Event Cancel (NEC) message. The NCCDS shall use the following variations of the NES as indicated:

a. Normal NES. The normal NES (type 90 class 01) is used for events transmitted more than 24 hours before event start time.

b. Emergency NES. The emergency NES (type 90 class 05) is used for events transmitted less than 45 minutes before event start time.

c. Update NES. The update NES (type 90 class 04) is used for all other events.

5.3.4.5 PTP Command Messages

Based on the WSGT and STGT schedules, the NCCDS controls the PTPs at each ground terminal via use of PTP Command messages. Although this interaction is functionally equivalent to transmission of schedule messages to the PTPs, this does not involve use of formatted messages per se.

For events that specify WDISC support, the NCCDS operator shall have the capability to transmit PTP Event Command messages to the prime and backup PTPs at the applicable ground terminal. If an event is deleted after a PTP Event Command message has been transmitted, the NCCDS shall send a PTP Delete Command message.

5.3.5 Responses to Schedules and Schedule Deletions

The responses to the transmitted schedules and schedule deletions vary depending on the type of message transmitted and the destination. The responses include the following:

a. Customers. There is no explicit message indicating a customer's response to a schedule or schedule deletion. The absence of a response implies acceptance. The customer may transmit a delete or a replace request if the schedule is unacceptable. The customer may transmit an add request if the deletion is unacceptable.

b. Ground terminals.

   1. For each SHO, the ground terminal that received the SHO will respond with a SHO Status message indicating that the SHO has either been accepted or rejected. Upon receipt of a SHO Status message indicating any condition other than unqualified acceptance, the NCCDS will alert the operator.

   2. For each Cancel SHO Request, the ground terminal that received the Cancel SHO Request will respond with an OPM Status message indicating that the Cancel SHO Request has either been accepted or rejected. Upon receipt of an OPM Status message indicating rejection of a Cancel SHO Request, the NCCDS will alert the operator. Also refer to paragraph 5.6.1 d.

3. For each PTP Event Command message, the PTP machine that receives the PTP Event Command message will respond with a PTP Event Response message indicating that the PTP Event Command message has either been accepted or rejected. Upon receipt of a PTP Event Reponse message indicating rejection, the NCCDS will notify the operator.

4. For each PTP Delete Command message, the PTP machine that receives the PTP Delete Command message will respond with a PTP Delete Response message indicating receipt of the PTP Delete Command message.

c. Customer support facilities. Although these facilities also receive schedule messages in the NES format, they provide no electronic message indicating their response. Therefore, it is always assumed that they have accepted the schedule. Similarly, these facilities provide no response to an NEC message.

5.3.6 TDRS Scheduling Windows

5.3.6.1 General

Use of TSWs is optional for scheduling via SARs. When TSWs are used with SARs, it is possible for the SAR to specify a range of event start times that spans more than one TDRS view period. The TSW message provides the customer with the capability to specify the TSWs for its spacecraft. Each TSW message specifies a TDRS, a TSW set ID, a timespan start, a timespan end, and the number of TSWs included in the message. For each included TSW, the TSW message specifies a window opening time and a window closing time. However, a TSW message may be empty (i.e., the number of TSWs is zero). This provides the capability to delete previous TSWs without storing any new TSWs.

5.3.6.2 Receipt of TSW Messages

For any customer, the NCCDS shall be capable of receiving TSW messages from either the customer or from a customer designated facility. Each customer will determine whether to provide TSW messages to the NCCDS, or to have some other facility provide them. Upon receipt of a TSW, the NCCDS shall determine whether it is valid. The NCCDS shall reject any TSW message that

a. Is not for a valid customer spacecraft.

b. Does not specify a valid TDRS operational name, or a valid TDRS set name. [Refer to Note 5.3.6.2-1.]

NOTE 5.3.6.2 – 1

Use of TDRS set names within TSW messages should be limited to those TDRS sets that include a single TDRS operational name (i.e., the TDRS set name is used as an alias for the TDRS operational name). When used in this way, the customer can use TDRS aliases to maintain multiple TSW subsets for the same TDRS in the same TSW set.

c. Contains a TSW with a duration less than the customer's specified minimum or greater than the customer's specified maximum.

d. Contains only TSWs with window closing times in the past.

e. Contains only TSWs with window opening times more than 28 days in the future.

f. Specifies a timespan end earlier than the timespan start.

g. Contains a TSW with window closing time earlier than window opening time.

h. Contains a TSW with window opening time or window closing time that does not lie within the timespan start and timespan end of the message.

i. Contains overlapping TSWs.

5.3.6.3 Invalid TSWs

If a TSW is invalid, the NCCDS shall alert the operator.

5.3.6.4 Valid TSWs

5.3.6.4.1 Storage

The NCCDS shall store valid TSWs such that they can be accessed in ascending time order by customer spacecraft, TSW set ID, and TDRS. When new TSW information is an update to previously stored TSW information for the same timespan, customer spacecraft, TSW set ID, and TDRS, the NCCDS shall alert the operator. When updated TSW information is stored, the NCCDS shall delete previous TSWs for the same customer spacecraft, TSW set ID, and TDRS and with window opening or window closing times that lie within the timespan start and timespan end of the new TSW message.

5.3.6.4.2 TSW Updates

Newly stored TSW information is defined as updated TSW information if it has resulted in deletion of old TSW information, if it applies to the time period of the active schedule, or if it applies to any pending schedule requests. The NCCDS will apply updated TSW information to previously scheduled events and previously stored schedule requests as follows:

a. Fixed events on the active schedule. The NCCDS shall review each applicable fixed event to verify that it still fits in the new TSW. If it does not, the NCCDS shall alert the operator.

b. Flexible events on the active schedule. The NCCDS shall review each applicable flexible event to verify that it still fits in the new TSW. If it does not, the NCCDS shall alert the operator.

c. Schedule activation. When the operator activates a schedule, the NCCDS reviews each event to verify that it works with the newest available TSWs. (Refer to paragraph 5.5.4.2.3.)

d. Batch schedules. For batch schedules that have not been activated, the NCCDS alerts the operator that new TSWs that may apply to the batch schedules have arrived. The NCCDS does not automatically review the schedules. The operator may rerun the schedules.

e. Requests that have never been scheduled. TSW updates have no immediate effect on queued requests. However, the NCCDS shall base subsequent attempts to schedule such requests on the updated TSWs rather than on the TSWs that were available when the requests were received.

f. Requests on the wait list. Refer to paragraph 5.5.6.7.

5.3.7 TDRSS Status

The ground terminals provide Service Level Report (SLR) messages that indicate the availability of schedulable resources within the ground terminals and onboard the TDRSs. For each failed resource, the SLR specifies an estimated time of return to operation (ETRO). In addition, the SLR lists all SHOs that are affected by current resource failures. Upon receipt of an SLR, the NCCDS shall alert the operator and shall provide the operator with the following capabilities:

a. Review the SLR.

b. Review events listed in the SLR as affected by resource failures.

c. Manually copy the status of individual resources from the SLR and apply it to the NCCDS's specifications of the availability of the same individual TDRS and ground terminal resources. (Refer to paragraphs 5.2.2.2 and 5.2.2.3.) [Refer to Note 5.3.7-1.]

NOTE 5.3.7 – 1

To facilitate this capability, the SLR display should present the status of the individual resources in a format and order that will allow the operator to make straightforward and accurate comparisons with the current status of these resources in the NCCDS database.

d. Determine the impact on scheduled events of the resource status changes entered above.

5.4 Scheduling Rules

5.4.1 General

The scheduling rules provided herein constrain the scheduling of SN events and services, and specify how certain types of information and messages are to be used in scheduling. The majority of the individual scheduling rules are specified independently of the other scheduling rules. However, in general, multiple rules apply to the scheduling of any one event or service. The NCCDS must determine that all applicable rules are met before an event or service can be placed on the schedule. For both batch scheduling and automatic update scheduling, the NCCDS shall apply the following five categories of scheduling rules to the scheduling of SN events and services:

a. TDRS selection.

b. TDRS Scheduling Windows.

c. SN resource scheduling ground rules.

d. Flexibility parameters.

e. Active period events.

5.4.2 TDRS Selection

Each schedule request specifies a customer SUPIDEN and either a TDRS or a set of TDRSs. For each customer SUPIDEN, a set of TDRSs is specified as valid in the database. In attempting to satisfy a schedule request for a given SUPIDEN, the NCCDS shall only use TDRSs that are both valid for that SUPIDEN and are specified by the schedule request. In addition, the NCCDS shall schedule events and services on a specified TDRS only when the TDRS operational name is both assigned to a TDRS ID (refer to paragraph 5.2.2.2c) and assigned to an SGLT (refer to paragraph 5.2.2.2d).

5.4.3 TDRS Scheduling Windows

Each SAR, Alternate SAR, or Replace Request specifies whether TSWs are to be used. If TSWs are to be used in the scheduling of an event, the NCCDS shall schedule each service such that it is fully contained within the intersection of the acceptable service times specified by the request and a TSW from the TSW set identified by the service's SSC. If upon attempting to schedule an event that requires use of TSWs the NCCDS determines that the applicable TSWs have not been stored within the NCCDS, the NCCDS shall alert the operator.

5.4.4 SN Resource Scheduling Ground Rules

5.4.4.1 General Rules

The following general rules apply to the scheduling of all events and services:

a. The NCCDS shall perform resource availability and timing relationship checks for TDRSS services, TDRSs, ground terminal resources, Nascom resources, and data sources and destinations.

b. Within an event, the NCCDS shall provide a minimum of 15 seconds between the stop and start of two services of the same type.

c. For all TDRSS services with specified setup times, the schedule generated by the NCCDS shall contain gaps between consecutive uses of these services equal to or greater than the specified setup times.

d. The NCCDS shall allow for specified setup times by maintaining gaps in the schedule. In some instances, more than one specified setup time may apply to the scheduling of the same service. In such cases, the NCCDS shall maintain a gap large enough for the longest applicable setup time.

e. The NCCDS shall schedule all services within an event on the same TDRS.

f. For each customer, the NCCDS shall maintain a minimum gap between consecutive events as specified by that customer's minimum gap parameters. However if an applicable minimum gap parameter is not specified, the NCCDS shall allow the customer's events to overlap unless precluded by resource conflicts. Refer to paragraph 5.2.3.3 q. When an event contains a mixture of SA and MA/SMA services, the NCCDS shall apply the longest applicable specified minimum gap. [Refer to Note 5.4.5.1-1.]

NOTE 5.4.5.1 – 1

For example, an SA event is following by a mixed event. The customer's SA-to-SA gap is 10 minutes, and the SA-to-MA/SMA gap is 5 minutes. The NCCDS would maintain a 10 minute gap.

5.4.4.2 SN Resource Availability

The NCCDS shall not schedule any event or service that requires the use of an unavailable resource. The determination of whether a resource is unavailable depends upon whether the resource is allocated discretely or incrementally.

a. The majority of resources are allocated discretely. They include the TDRS resources listed in paragraph 5.2.2.2 and the ground terminal resources listed in paragraph 5.2.2.3, as well as user interface channels. At any time, a discretely allocated resource is unavailable if either of the following are true:

   1. The resource has been allocated to a scheduled event or service.

   2. The resource has been marked unavailable by the operator.

b. The incrementally allocated resources include the aggregate MDM bandwidth (refer to paragraph 5.2.2.5) and the aggregate HDRM bandwidth (refer to paragraph 5.2.2.6). For a particular service, such resources are unavailable when the difference between the total bandwidth and the maximum bandwidth allocated at any time during the service is

less than the bandwidth required to support the service. Note that such a resource may be unavailable for one service but available for a different service with a lower bandwidth requirement.

5.4.4.3 TDRSS Forward and Return Services

5.4.4.3.1 General

There are ten types of TDRSS forward and return services:

- SSAF.
- SSAR.
- KuSAF.
- KuSAR.
- KaSAF.
- KaSAR.
- MAF.
- MAR.
- SMAF.
- SMAR.

5.4.4.3.2 Single Access Service Ground Rules

The NCCDS is to schedule TDRSS SA services according to the following rules:

a. Except for events containing SSAR combining services that use both SA antennas on a TDRS, the NCCDS shall schedule all SA services within an event on the same SA antenna. The NCCDS shall allocate both SA antennas to SSAR combining services. However, within schedule messages the NCCDS shall always specify the antenna for SSAR combining services as SA1.

b. Whenever a SA service is requested but the SA antenna is not specified via the schedule request, the NCCDS shall select the SA antenna used to support the service.

c. At any time, all SA services scheduled on an SA antenna must be part of the same event.

d. The NCCDS shall not schedule Ku-band and Ka-band services on the same SA antenna at the same time.

e. A "use" of an SA antenna is herein defined as a continuous set of one or more SA services on the same SA antenna within the same event.

1. The NCCDS shall provide an operator-specified setup time between consecutive uses of each SA antenna when those uses are within different events. Refer to paragraph 5.2.4.8. The nominal value for this setup time is 90 seconds. [Refer to Note 5.4.4.3.2-1, 2.]

NOTE 5.4.4.3.2 – 1

The highest foreseeable altitude of any orbiting customer spacecraft is approximately 1340 kilometers. For TDRS A-G, the nominal SA antenna setup time of 90 seconds allows the antenna to slew through an angle of 22.5 degrees at the specified rate of 0.25 degrees per second. This is larger than the angle defined by a customer spacecraft at an altitude of 1340 kilometers at one horizon, a TDRS, and another customer spacecraft at the same altitude at the opposite horizon. The operator may need to temporarily modify the SA antenna setup time parameter during times when the SN is supporting expendable launch vehicles (ELVs) or is supporting insertions of spacecraft into geosynchronous orbits.

NOTE 5.4.4.3.2 – 2

For TDRS H-J, a minimum SA antenna setup time of 120 seconds will be required. When the first of these TDRSs becomes operational, the nominal value will become 120 seconds.

2. The NCCDS shall provide a 30-second setup time between consecutive uses of each SA antenna when those uses are within the same event.

f. Ka-band return services provide users with either normal (225 Mhz) or wideband (650 Mhz) radio frequency (RF) channel bandwidth.

1. The NCCDS shall schedule normal bandwidth Ka-band return services only as data group 2 services and only as noncoherent services.

2. The NCCDS shall schedule wideband Ka-band return services only on single access antenna 1 (SA1) and only in the IF service configuration.

3. All other scheduling rules applicable to Ka-band return services apply to both normal bandwidth and wideband services. [Refer to Note 5.4.4.3.2-3.]

NOTE 5.4.4.3.2 – 3

Herein, the term “KaSAR” applies to all Ka-band return services. In other documents, the term “KaSA1WB” applies to wideband services while the terms “KaSA1” and “KaSA2” apply only to normal bandwidth services.

g. The NCCDS shall not use Ka-band services for Shuttle support.

5.4.4.3.3 Multiple Access Service Ground Rules

The NCCDS is to schedule TDRSS MA services according to the following rules:

a. Whenever an MAR service is requested, the NCCDS shall select the MAR link ID used to support the service. The MAR link ID is not explicitly specified in either a schedule request or in an SSC.

b. The NCCDS shall assign the same MAR link ID to all MAR services within an event, and shall allocate that MAR link ID to the event from the earliest MAR service start time in the event to the latest MAR service stop time in the event.

c. The NCCDS shall not assign the same MAR link ID to concurrent MAR services for the same TDRS.

d. The NCCDS shall provide a 30-second setup time between consecutive uses of the same MAR link ID for the same TDRS when those consecutive uses lie in different events.

e. The NCCDS shall provide a 30-second setup time between consecutive uses of the MAF service of a TDRS when those consecutive uses lie in different events.

f. The NCCDS shall not use MA services for Shuttle support.

5.4.4.3.4 S-Band Multiple Access Service Ground Rules

The NCCDS is to schedule TDRSS SMA services according to the following rules:

a. Whenever an SMAR service is requested, the NCCDS shall select the SMAR link ID used to support the service. The SMAR link ID is not explicitly specified in either a schedule request or in an SSC.

b. The NCCDS shall assign the same SMAR link ID to all SMAR services within an event, and shall allocate that SMAR link ID to the event from the earliest SMAR service start time in the event to the latest SMAR service stop time in the event.

c. The NCCDS shall not assign the same SMAR link ID to concurrent SMAR services for the same TDRS.

d. The NCCDS shall provide a 30-second setup time between consecutive uses of the same SMAR link ID for the same TDRS when those consecutive uses lie in different events.

e. The NCCDS shall provide a 30-second setup time between consecutive uses of the SMAF service of a TDRS when those consecutive uses lie in different events.

f. The NCCDS shall not use SMA services for Shuttle support.

g. The NCCDS shall schedule SMAR services in left circular polarization (LCP) only.

5.4.4.3.5 Coherent Pairs Ground Rules

A coherent pair of services may be either a KuSAR and a KuSAF, an SSAR and an SSAF, an SSAR and a MAF, an SSAR and an SMAF, an MAR and an MAF, an SMAR and an SMAF, an MAR and an SSAF, or an SMAR and an SSAF. The NCCDS shall ensure that for a return service whose initial state is coherent, the related forward service starts no later than the start time of the return service.

5.4.4.3.6 Maximum Composite Data Rate Rules

5.4.4.3.6.1 Data Flow in The Return Direction

Refer to paragraph 5.2.2.3 f. For each SGLT, the NCCDS shall ensure that the sum of the maximum data rates for scheduled data flow in the return direction does not exceed the maximum composite return direction data rate specified for that SGLT. The NCCDS shall not include the maximum data rates for scheduled data flow using any user interface channel mapped to a GRGT LI port. For the purpose of this calculation, Shuttle video data is to be treated as if it were digital data with the data rate specified by the operator. Refer to paragraph 5.2.2.3 h. [Refer to Note 5.4.5.3.6.1-1.]

NOTE 5.4.5.3.6.1 – 1

The NCCDS's implementation of this function, and of the related function for data flow in the forward direction (see below), assumes stable mappings of TDRS operational names to TDRS IDs and SGLTs (refer to 5.2.2.2 c. and d.). Modifications of these mappings may result in temporarily invalid determinations of the sum of the maximum data rates. In particular, this applies to the TDRS operational name mapped to GRGT.

5.4.4.3.6.2 Data Flow in The Forward Direction

Refer to paragraph 5.2.2.3 g. For each SGLT, the NCCDS shall ensure that the sum of the maximum data rates for scheduled data flow in the forward direction does not exceed the maximum composite forward direction data rate specified for that SGLT. The NCCDS shall not include the maximum data rates for scheduled data flow using any user interface channel mapped to a GRGT LI port.

5.4.4.4 Tracking Services

5.4.4.4.1 General

There are two types of tracking services as follows:

a. Normal tracking services may be either one-way Doppler with an associated return service or range, two-way Doppler, and time transfer with associated return and forward services on the same antenna.

b. Cross tracking services are range, two-way Doppler, and time transfer with associated S-band return and forward services on antennas of different types (e.g., forward is on SA with return on MA).

5.4.4.4.2 Scheduling Ground Rules

The NCCDS shall schedule the use of TDRSS tracking services according to the following ground rules:

a. Each tracking service is to have an associated SSAR, KuSAR, MAR, or SMAR return service. The associated return service cannot be a KaSAR service. The associated return service cannot be in the IF service configuration.

b. Each tracking service with range and/or two-way Doppler and/or time transfer measurements is to also have an associated forward service. The return and forward services may be paired as follows:

   1. Ku-band SA (KuSA) normal support (i.e., KuSA forward and return on same SA antenna).

   2. S-band SA (SSA) normal support (i.e., SSA forward and return on same SA antenna).

   3. MA normal support (i.e., any MAR and the MAF).

   4. SMA normal support (i.e., any SMAR and the SMAF).

   5. SSA cross support (i.e., any SSAR and the MAF, or any SSAR and the SMAF).

   6. MA cross support (i.e., any MAR and any SSAF).

   7. SMA cross support (i.e., any SMAR and any SSAF).

c. At any time, each return service is to be associated with at most one tracking service.

d. At any time, each forward service is to be associated with at most one tracking service.

e. The start time of a tracking service is to be later than or equal to the start times of the associated forward and/or return services.

f. The stop time of the tracking service is to be earlier than or equal to the stop times of the associated forward and/or return services.

5.4.4.5 End-to-End Test Services

5.4.4.5.1 General

TDRSS end-to-end test (EET) services and customer simulators within the TDRSS allow the TDRSS telecommunication services to be independently exercised and provide the capability for end-to-end data flow simulations.

5.4.4.5.2 Ground Rules

The NCCDS shall schedule the use of TDRSS EET services according to the following ground rules:

a. Each EET service is to be associated with either a normal forward traffic service or a normal return traffic service.

NOTE 5.4.4.5.2 - 1

Although not prohibited, EET services having an associated Ku-band return services in the IF service configuration are not applicable.

b. Each SGLT provides the capability to support the following:

1. One S-band EET which at any time during the test may include a maximum of one forward EET service, one return EET service, and associated normal traffic and tracking services. (S-band EETs may include SSA services, MA services, SMA services, SSA and MA services, or SSA and SMA services.)

2. One Ku-band EET which at any time during the test may include a maximum of one forward EET service, one return EET service, and associated normal traffic and tracking services.

3. The S-band EET and the Ku-band EET may each be scheduled as separate EET events, or combined in a single EET event.

c. The start and stop times of an EET service are to be the same as that of the associated forward or return service.

d. Data for an EET may be either locally generated or provided by the customer via the ground terminal's Data Interface System (DIS). Data for an EET may also be locally played back from a recording of the customer's data; however, this is specified in the SHO as if it were provided by the customer via the DIS. The SSCs for the EET service and its associated forward or return service specify whether scheduling of SN data transport resources is needed. If such scheduling is needed, it is to be performed as specified in 5.4.5.9.

e. Setup times are to be provided as follows: [Refer to Note 5.4.5.5.2-1.]

1. Setup times for normal forward traffic and normal return traffic services are specified in paragraph 5.4.5.3. *No additional setup times are needed for normal traffic services included in EET events.*

2. *The NCCDS shall provide a 3-minute and 30 second setup time prior to each EET event*.

   (a) If the EET event contains S-band services, no other S-band EET can be scheduled at the same SGLT from the beginning of the 3-minute and 30 second setup time until the end of the last S-band service.

   (b) If the EET event contains Ku-band services, no other Ku-band EET can be scheduled at the same SGLT from the beginning of the 3-minute and 30 second setup time until the end of the last Ku-band service.

NOTE 5.4.5.5.2 – 1

The NCCDS provides set-up times for EET events as had been specified in Revision 1 of this document. These set-up times will be satisfactory in nearly all operational situations.

f. The normal forward traffic service associated with an EET service must have Doppler compensation enabled. For Shuttle SSAF, both carrier Doppler compensation and PN rate Doppler compensation must be enabled.

g. The following additional rules apply to Shuttle EETs:

   1. Shuttle EETs with data input to the ground terminal via the DIS are limited to digital data only.

   2. A Shuttle EET can only include a single EET service.

   3. Each ground terminal (i.e., STGT and WSGT) can only support a single Shuttle EET.

   4. A 20-second setup time is required between Shuttle end-to-end tests at the same ground terminal, even if the tests use a different TDRS.

5.4.4.6 Tape Playback Services

Tape playback services will be provided by the ground terminals in order to allow data recorded at the ground terminal to be transmitted to the customer. When a tape playback service is requested, the NCCDS shall allocate the requested data sources and data destinations (refer to paragraph 5.4.5.9) and the necessary MDM bandwidth (refer to paragraph 5.4.5.7.2) or HDRM bandwidth (refer to paragraph 5.4.5.7.3). For the purpose of these allocations, the NCCDS shall regard a tape playback as a return service. However, no SGLT or TDRS resources are to be allocated to the tape playback.

5.4.4.7 Multiplexer Capacities

5.4.4.7.1 General

The MDMs and the HDRMs may be shared by several customers. The NCCDS shall not schedule any service that would cause the specified capacity of either the MDM or the HDRM to be exceeded. Note that the MDMs and the HDRMs at STGT and at WSGT are interconnected in a way that, in effect, creates a single MDM and a single HDRM for the purposes of NCCDS scheduling.

5.4.4.7.2 Multiplexer/Demultiplexer Duty Factors

The NCCDS shall schedule the use of the MDMs according to the following ground rules:

a. For each of the MDMs at the ground terminals, GSFC, and JSC, the allowable composite bandwidth of the MDM data system uplink shall be its specified maximum bandwidth capacity minus its specified fixed overhead. (Refer to paragraph 5.2.2.5.)

b. The NCCDS shall ensure that the MDM data system uplink bandwidth capacity is not exceeded at the ground terminals, GSFC, or JSC. The NCCDS shall calculate bandwidth allocations as follows:

   1. When SN data transport resources are scheduled to support data flow in the return direction (i.e., data flowing from the TDRSS to the customer) through the MDM, the MDM maximum data rate for that service plus 5.6 percent for MDM overhead shall be added to the current allocation within the ground terminal uplink allowable composite bandwidth.

   2. When SN data transport resources are scheduled to support data flow in the forward direction (i.e., data flowing from the customer to the TDRSS) from JSC through the MDM, the MDM maximum data rate for that service plus 5.6 percent for MDM overhead shall be added to the current allocation within the JSC uplink allowable composite bandwidth.

   3. When SN data transport resources are scheduled to support data flow in the forward direction from GSFC through the MDM, the MDM maximum data rate for that service plus 5.6 percent for MDM overhead shall be added to the current allocation within the GSFC uplink allowable composite bandwidth.

   4. Data rates less than 4.624 kb/sec shall be treated as if they were 4.624 kb/sec for the purpose of bandwidth allocation.

c. The maximum data rate for a single MDM return channel is 7 Mb/sec.

d. The maximum data rate for a single MDM forward channel is 7 Mb/sec.

e. The minimum data rate for forward and return channels is zero. The minimum nonzero data rate for forward and return channels is 10 bits per second (b/sec).

5.4.4.7.3 High Data Rate Multiplexer Duty Factors

The NCCDS shall schedule the use of the HDRMs according to the following ground rules:

a. Normally, there are four available input ports on the HDRM. (Refer to paragraph 5.2.2.6.)

b. Port numbers scheduled for one ground terminal shall not be scheduled for simultaneous use at the other ground terminal (GT).

c. The maximum data rate on each HDRM input port is 48 Mb/sec.

d. The minimum data rate on each HDRM input port is zero. The minimum nonzero data rate on each HDRM input port is 125 kb/sec.

e. The combined data rates of all scheduled HDRM input ports shall normally not exceed 48 Mb/sec. (Refer to paragraph 5.2.2.6.)

5.4.4.8 DELETED

5.4.4.9 Data Sources and Data Destinations

5.4.4.9.1 General

For all services other than tracking services, the NCCDS shall schedule the communications path related to the physical flow of the data. This involves specification of data sources and data destinations in terms of user interface channels, MDM port addresses, and other related sources and destinations. User interface channels are the connections between Nascom and customer facilities. MDM port addresses are the logical designation of the MDM ports.

5.4.4.9.2 Scheduling Ground Rules

The NCCDS shall schedule data sources and data destinations according to the following ground rules:

a. DELETED

b. The NCCDS shall select the user interface channels to be allocated to a service from among the user interface channels specified by the SSC associated with the requested service. For each data channel, the SSC may specify one or more individual user interface channels. In all cases, the NCCDS shall select user interface channels valid for the type of data to be flowed by the service (refer to paragraph 5.2.2.7.1) and valid for the customer (refer to paragraph 5.2.3.3 j). [Refer to Notes 5.4.4.9.2-2, 3, 4.] The following special cases apply to the GRGT LI:

   1. If a schedule request applies only to the TDRS assigned to GRGT (i.e., the third WSGT SGLT) and an SSC includes any user interface channel mapped to a GRGT

LI port, the NCCDS shall select only user interface channels mapped to GRGT LI ports.

2. The NCCDS shall not use user interface channels mapped to GRGT LI ports in any other case.

NOTE 5.4.4.9.2 – 2

SSCs will usually specify exactly the set of user interface channels needed to schedule the service, i.e., all of the user interface channels specified in the SSC will be allocated to the service. However, there are circumstances when additional user interface channels will be specified, For example if some of a customer's user interface channels are valid for only STGT and others are valid for only WSGT, that customer's SSCs may include a complete set of STGT user interface channels and a complete set of WSGT user interface channels. The NCCDS would then select the user interface channels after it is known which ground terminal will support the event.

NOTE 5.4.4.9.2 – 3

At most one user interface channel may be allocated to a forward service. The types of user interface channels valid for forward services are MDM, LI, and WDISC.

NOTE 5.4.4.9.2 – 4

As many as five user interface channels may be allocated to a single return service data channel. The types of user interface channels valid for return services are IF, LI, WDISC, MDM, HDRM, video, analog, and record only. These may be allocated in any one of five combinations: (1) one low rate LI and/or one high rate LI; (2) one MDM and/or one HDRM and/or one record only; (3) one IF (applicable only to KSAR); (4) one video and/or one analog and/or one MDM and/or one HDRM and/or one record only (applicable only for Shuttle KSAR Channel 3); and (5) one WDISC. For some service types, further limitations on the types of user interface channels that may be allocated are implied by the maximum data rate for the service type.

c. The NCCDS shall schedule a 20-second reconfiguration period between consecutive uses of each user interface channel.

d. For SA return and SMA return services, it is possible to perform reconfigurations (e.g., to higher or lower data rates) that cannot be supported by the user interface channels required to support the initial configuration of the service. When such reconfigurations are intended, the service's SSC must include the user interface channels necessary to support them. For each requested service, the NCCDS shall select a minimum set of user interface channels sufficient to support the intended reconfigurations to the service.

The intended reconfigurations may be inferred from the user interface channels included in the SSC, i.e., it may be assumed that a particular reconfiguration is not intended if the user interface channels needed to support it have not been specified. The NCCDS shall allocate all selected user interface channels to the service for its entire duration.

e. Each forward service shall include no more than one data stream, with a single source (i.e., user interface channel) and a single destination for that stream.

f. Each return service shall include no more than three simultaneous data streams, with a single source and a single destination (i.e., user interface channel) for each stream. However, the destination may represent a multicast IP address.

g. MDM port address assignments for a service shall be determined from the scheduled user interface channel or channels for the service.

h. The NCCDS shall be capable of specifying use of the MDM system for the routing of data in both the forward and return directions.

i. The NCCDS shall be capable of specifying use of the HDRMs for the routing of data in the return direction.

j. The NCCDS shall be capable of specifying that return service data is to be recorded without further routing.

k. The NCCDS shall be capable of specifying that return service data is to be routed via a path dedicated to video data.

l. The NCCDS shall be capable of specifying that return service data is to be routed via a path dedicated to analog data. [Refer to Note 5.4.4.9.2-3.]

NOTE 5.4.4.9.2 – 3

The flow of video data, analog data, and high rate digital data via the HDRM may produce conflicts on the use of WSGT's high-data-rate common carrier. These conflicts will be resolved via operational procedures. There is no requirement for the NCCDS to automatically avoid these conflicts.

m. The NCCDS shall be capable of specifying that forward and return data is to be routed via LI ports.

n. The NCCDS shall be capable of specifying that data in the return direction is to be routed via IF ports.

o. The NCCDS shall be capable of specifying that forward and return data is to be routed via WDISC ports.

p. Both members of a pair of WDISC user interface channels (i.e., a PTP board) shall be allocated whenever either member is scheduled in an event. (Refer to 5.2.2.7.2o.)

5.4.5 Flexibility Parameter Rules

The schedule request and prototype event formats provide for the specification of nominal values and tolerances on event start time, relative service start times, and service durations. In addition, the Alternate SAR allows for a different event to be scheduled when the event specified by the request referenced by the Alternate SAR cannot be scheduled. The NCCDS shall employ the specified flexibility of each request, as needed, to allow the requested event to be scheduled consistent with the current scheduling priorities.

a. The NCCDS shall attempt to avoid conflicts within the batch scheduling process or automatic scheduling update process by applying the flexibility parameters in the following preference order: [Refer to Note 5.4.6-1.]

   1. Select alternate TDRSS resources (e.g., TDRSs and SA antennas).

   2. Move event start time and/or relative service start times. The NCCDS shall move start times by the smallest amount necessary to allow the requested event to be scheduled consistent with the current scheduling priorities.

   3. Shorten service durations. The NCCDS shall shorten service durations by the smallest amount necessary to allow the requested event to be scheduled consistent with the current scheduling priorities.

NOTE 5.4.6 – 1

Because of the need to achieve a satisfactory balance of scheduling performance and scheduling effectiveness (refer to paragraphs 5.9.4 and 5.9.5), the NCCDS scheduling algorithm cannot always make optimal use of all customer-specified scheduling flexibility. A more detailed discussion is provided at the end of Appendix D of 451-ICD-NCCDS/MOC.

b. When flexibility parameters are applied to relative service start times and service durations, the NCCDS shall structure each event such that there is no time during the event during which no service is scheduled (i.e., there are to be no gaps within the event).

c. When flexibility parameters are applied to relative service start times and service durations, the NCCDS shall structure each event such that there is a minimum of one minute of overlap between any return service whose initial state is coherent and its related forward service. Refer to paragraph 5.4.5.3.5.

d. The NCCDS shall attempt to schedule an event in response to an Alternate SAR only after all possibilities for scheduling an event in response to the request referenced by the Alternate SAR have been exhausted.

5.4.6 Active Period Events

5.4.6.1 General

After a USM has been transmitted to a customer for an active period event, the SN is obligated to provide the support specified in the USM. The NCCDS will delete or modify active period events only as specified in the following paragraphs.

5.4.6.2 Event Stop Times

Events are implicitly removed from the active schedule when they reach their scheduled event stop times.

5.4.6.3 Deletion

The NCCDS shall remove events from the active schedule only under the following circumstances:

a. The operator selects the event for reprocessing in a batch process which fails to schedule the event, and the operator subsequently activates the results of the batch.

b. A Delete Request refers to the event.

c. A Replace Request refers to the event.

d. The operator deletes the event.

5.4.6.4 Modification of Fixed Events

A fixed-event USM exactly specifies the start and stop times of each service in the event, and exactly specifies the major SN resources (i.e., TDRS and TDRS antennas) allocated to the event. The NCCDS shall not modify any fixed event except in response to a request from the event's customer or in response to operator action.

5.4.6.5 Modification of Flexible Events

A flexible-event USM specifies that the customer will receive support, but allows for adjustment of certain parameters without explicit approval by the customer. In general, a flexible event will not be modified until it is frozen (refer to paragraph 5.5.5) or unless the operator includes it in a batch schedule (refer to paragraph 5.5.3.3).

5.5 Scheduling Process

5.5.1 General

The scheduling process creates the initial schedule for a given time period and, as needed, updates the initial schedule. The NCCDS requirements for the scheduling process are partitioned into the following areas:

- Scheduling boundaries.
- Batch scheduling.
- Schedule activation.
- Freezing of active schedule events.
- Automatic schedule updates.
- Additional operator capabilities.

5.5.2 Scheduling Boundaries

5.5.2.1 General

The details of the requirements for the scheduling process vary depending upon the following:

a. The relationship between the requests to be processed and the boundary between the initial schedule generation period and the active period.

b. The relationship between the requests to be processed and the boundary between the SAR batch scheduling subphase and the SAR automatic schedule update subphase.

5.5.2.2 Boundary Between The Initial Schedule Generation Period and The Active Period

The boundary between the initial schedule generation period and the active period is implicitly defined by the event start time that is the furthest in the future of all events that have been activated by the operator (refer to paragraph 5.5.4). This boundary will typically be between 7 and 14 days in the future, and may move further into the future whenever the operator activates an event. Within the NCCDS the boundary is based on active events; however, even though there is always some delay between the activation of the schedule and the transmission of the schedule, the active period is generally regarded as the time period for which the NCCDS has transmitted USMs to customers.

5.5.2.3 Boundary Between The SAR Batch Scheduling and SAR Automatic Scheduling Subphases

At any time, the boundary between the SAR batch scheduling and the SAR automatic schedule update subphases is explicitly determined by criteria specified by the operator (refer to paragraph

5.2.4.4). This boundary will lie within the active period and will typically be between 2 and 4 days in the future. [Refer to Note 5.5.2.3-1.] SARs that apply to times between the current time and the boundary will be automatically processed. SARs that apply to times further in the future than the specified boundary will only be processed under operator control via batch scheduling; however, the operator may also include requests applicable to the SAR automatic scheduling update period in a batch scheduling run. Batch scheduling applies to both the initial schedule generation period and to the active period.

NOTE 5.5.2.3 – 1

Refer to paragraph 5.2.4.4.4. It is possible for this boundary to lie in the past. In such cases, all incoming SARs will be queued for batch scheduling. It is not anticipated that this will occur in normal operations.

5.5.3 Batch Scheduling

5.5.3.1 General

Batch scheduling provides the capability for the NCCDS to process many schedule requests within the same batch. In contrast to automatic scheduling (refer to paragraph 5.5.6), batch scheduling makes more efficient use of SN resources and satisfies a greater percentage of customer requests because the system is able to consider each request in the context of all of the other requests within the same batch and to automatically adjust each request to facilitate the scheduling of the others. In automatic scheduling, the system must attempt to schedule each request as soon as it is received and has less freedom to adjust previously scheduled events to accommodate newly received requests.

5.5.3.2 Automatic Scheduling Lockout

During batch scheduling, the NCCDS shall lockout all automatic schedule updates applicable to the same part of the active schedule to which the batch scheduling applies. The NCCDS shall reenable automatic processing when

a. The operator activates a batch schedule related to the lockout.

b. The operator deletes all batch schedules related to the lockout.

5.5.3.3 Batch Scheduling Data Selection

The NCCDS shall provide the operator with the capability to select the data to be used in any batch scheduling process. The selectable data includes any combination of the following:

a. A subset of the schedule requests that have not yet yielded events on the active schedule and that have not been placed on the wait list.

b. A subset of the results of a previous batch scheduling process.

c. A subset of active events to be reprocessed.

5.5.3.4 Batch Scheduling Execution

After the operator has selected the data for a batch scheduling process, the NCCDS shall provide the operator with the capability to initiate the process. For the selected requests to be processed and the selected events to be reprocessed, the NCCDS shall then generate a schedule that complies with all applicable scheduling rules and is consistent with the current scheduling priorities. The NCCDS shall not remove any events from the active schedule unless they have been selected by the operator for reprocessing. Unless precluded by the customer-specified freeze intervals in the database or in the schedule request, the NCCDS shall generate a flexible event whenever any service within the event has been scheduled with a reduced duration. In all other cases, the NCCDS shall generate fixed events. The NCCDS shall generate flexible events within the schedule such that they retain flexibility with regard to the following:

a. TDRS.

b. SA antenna.

c. Event start time.

d. Service start time.

e. Service duration.

5.5.3.5 Batch Scheduling Results

Upon completion of a batch scheduling process, the NCCDS shall notify the operator that the process is complete and provide the operator with the capability to review the results. (Refer to paragraph 5.7.)

5.5.3.6 Retention of Batch Scheduling Results

The NCCDS shall retain a schedule generated by a batch scheduling process until the schedule is deleted, activated, or modified by the operator, or until the criteria for automatic purging are met. (Refer to paragraph 5.2.4.7.)

5.5.3.7 Batch Scheduling Modification

The NCCDS shall provide the operator with the capability to modify the results of a previous batch scheduling process by

a. Deleting the entire schedule.

b. Removing selected events.

c. Selecting additional requests to be included in the batch and then reprocessing the batch without removal of any successfully processed events.

d. Reprocessing the same batch, but with a modified scheduling priorities list.

5.5.4 Schedule Activation

5.5.4.1 General

After the operator has executed one or more batch scheduling processes, the NCCDS shall provide the operator with the capability to select a schedule for activation. When the operator indicates that a schedule is to be activated, the NCCDS shall not allocate the resources used by the newly activated events to any other events and shall make these events available for initial activation mode schedule transmission. (Refer to paragraph 5.6.2.2.) When the schedule to be activated includes operator-selected successfully reprocessed events that had already been frozen, the NCCDS shall transmit the same set of external messages that would be transmitted if these events had been scheduled in response to operator-entered Replace Requests. When the schedule to be activated includes operator-selected unsuccessfully reprocessed events regardless of whether frozen or flexible, the NCCDS shall transmit the same set of external messages that would be transmitted if these events had been deleted in response to operator-entered Delete Requests.

5.5.4.2 Audit

5.5.4.2.1 Completeness

When the operator selects a schedule for activation, the NCCDS shall audit the schedule to ensure that the batch schedule processing that created the schedule included all schedule requests applicable to the time period of the selected schedule. If any were omitted, the NCCDS shall alert the operator and provide the operator with a display indicating the omitted requests.

5.5.4.2.2 Conflicts

When the operator selects a schedule for activation, the NCCDS shall audit the schedule to ensure that it does not conflict with any events on the active schedule. If there are any conflicts, the NCCDS shall automatically deselect the batch, alert the operator and provide the operator with a display indicating the conflicts.

5.5.4.2.3 TDRS Scheduling Windows

When the operator activates a schedule, the NCCDS shall review each event to verify that each service within the event fits within the newest available applicable TSWs. If there are any that do not, the NCCDS shall alert the operator.

5.5.4.2.4 TDRS Mapping Updates

When the operator activates a schedule, the NCCDS shall review each event to verify that it is valid in terms of the newest TDRS mappings (refer to paragraph 5.2.2.2). If any are not valid, the NCCDS shall alert the operator.

5.5.4.3 Operator Prompts

If a batch schedule is still selected for activation after the above audit process is completed, the NCCDS shall:

a. Inform the operator that the audit is complete.

b. Allow the operator to review all other related batch schedules (i.e., the operator's own batch schedules and any other overlapping batch schedules).

c. Provide the following options:

   1. Complete activation of the selected batch and delete all other related batch schedules.

   2. Deselect the batch schedule.

d. If the activation option is selected, then prompt the operator to initiate schedule transmission. (Refer to paragraph 5.6.2.2.)

5.5.4.4 Wait List

After a schedule is activated, the NCCDS shall place all requests within the activated batch on the wait list that meet the following criteria:

a. The request was declined.

b. The request specifies that it is to be placed on the wait list if it is declined.

c. The request applied to the active period when it was received.

d. An attempt to place the request on the wait list in response to a Wait List Request would be valid according to the rules stated in paragraphs 5.3.2.2.7.2 and 5.3.2.2.7.4.

5.5.5 Freezing of Active Schedule Events

Except for events added in the SAR automatic schedule update subphase, the NCC will generally transmit schedule messages to customers before the corresponding schedule messages are transmitted to network elements. Events with reduced service duration added to the schedule via a batch scheduling process will generally retain some flexibility until they are frozen and become fixed events. Within the constraints of the applicable scheduling rules and the current scheduling priorities, the NCCDS shall freeze events by selecting values for the flexibility parameters according to the rules specified in paragraphs 5.4.6 a. and b. However, the NCCDS shall not reduce the duration of any service to less than its original value unless this is necessitated by the event's customer's own TSW updates. Whenever an event is frozen, the NCCDS shall make the fixed event available for schedule transmission. The NCCDS shall freeze each flexible event whenever the first of the following occurs:

a. The freeze interval specified in the schedule request is reached.

b. The customer's default freeze interval (refer to paragraph 5.2.3.3k) is reached and the schedule request did not specify a freeze interval.

c. The event is selected for schedule transmission to any destination not on the customer's distribution list for flexible USMs. (Refer to paragraph 5.2.3.3m.)

5.5.6 Automatic Schedule Updates

5.5.6.1 General

As stated in paragraphs 5.2.4.4 and 5.5.2.2, the operator will have the capability to specify the boundary between the SAR batch scheduling and the SAR automatic scheduling updates subphases. SARs that apply to times further in the future than the specified boundary will be processed via batch scheduling. SARs that apply to times between the current time and the boundary will be automatically processed. Replace Requests and Delete Requests applicable to events that have been transmitted to customers will be automatically processed regardless of the specification of the boundary. The NCCDS requirements for automatic schedule updates are partitioned into the following areas:

- Schedule Add Request.
- Reset of the boundary between the SAR batch scheduling and the SAR automatic scheduling update subphases.
- Replace Request.
- Delete Request.
- Wait list processing

5.5.6.2 Schedule Add Request

When a valid SAR is received that is applicable to the SAR automatic schedule update subphase, the NCCDS shall attempt to schedule an event that satisfies the request and complies with all applicable scheduling rules. The NCCDS shall control interactions between the SAR and active period flexible events in accord with the current scheduling priorities.

a. If the attempt is successful, the NCCDS shall

   1. Transmit an SRM to the customer’s primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

   2. Make the scheduled event available for schedule transmission.

   3. Alert the operator if the update occurs within an operator-specified interval from the current time. (Refer to paragraph 5.2.4.5.)

b. If the attempt is unsuccessful, the NCCDS shall

   1. Transmit an SRM to the customer’s primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

2. Alert the operator.

3. Place the request on the wait list if this action is specified in the request.

5.5.6.3 Reset of the Boundary Between The SAR Batch Scheduling and The SAR Automatic Scheduling Update Subphases

As stated in paragraph 5.2.4.4, the NCCDS will reset the boundary between the SAR batch scheduling and the SAR automatic scheduling update subphases according to criteria specified by the operator. Whenever the boundary is reset for any reason, the NCCDS shall then review the SARs currently stored for batch scheduling and determine if there are any that now fall within the SAR automatic scheduling update subphase and that have neither resulted in an event being placed on the active schedule nor have resulted in an SRM indicating the request has been declined. The NCCDS shall automatically process any such SARs together with any Alternate SARs linked to these SARs.

5.5.6.4 Replace Request

When a valid Replace Request is received that is applicable to an event on the active schedule, the NCCDS shall attempt to schedule an event that satisfies the request and complies with all applicable scheduling rules. [Refer to Note 5.5.6.5-1.] If applicable, the NCCDS shall be capable of using resources allocated to an event referenced by the Replace Request to satisfy the Replace Request.

a. If the attempt is successful, the NCCDS shall

   1. Transmit an SRM to the customer's primary logical destination indicating that the Replace Request was successfully processed, or provide an equivalent alert to the NCC operator if the operator originated the request.

   2. Delete the referenced event and transmit messages indicating the deletion to all destinations to which schedule messages had previously been transmitted. These messages include the following:

      (a) Cancel SHO Request OPMs to WSGT and to STGT.

      (b) NEC messages to the NEST, and to customer support facilities.

      (c) SRMs to customers.

   3. Make the scheduled event available for schedule transmission.

   4. Alert the operator if the update occurs within an operator-specified interval from the current time. (Refer to paragraph 5.2.4.5.)

b. If the attempt is unsuccessful, the NCCDS shall

   1. Transmit an SRM to the customer's primary logical destination, or provide an equivalent alert to the NCC operator if the operator originated the request.

   2. Alert the operator.

NOTE 5.5.6.5 – 1

The delete function of a Replace Request is applicable until the actual event stop time of the referenced event (i.e., a replace request may result in the deletion of an ongoing event). The add function of a Replace Request must fully comply with all rules applicable to adding events to the schedule. If a Replace Request deletes an ongoing event, there must therefore be a gap of at least five minutes prior to the start of the new event.

3. Place the request on the wait list if this action is specified in the request.

5.5.6.5 Delete Request

[Refer to Note 5.5.6.6-1.] When a valid Delete Request applicable to an event on the active schedule is received, the NCCDS shall

a. Delete the event referenced by the request.

b. Transmit messages indicating the deletion to all destinations to which schedule messages had previously been transmitted. These messages include the following:

   1. Cancel SHO Request OPMs to the ground terminals.

   2. NEC messages to the NEST and to customer support facilities.

   3. SRMs to customers.

c. Alert the operator if the update occurs within an operator-specified interval from the current time. (Refer to paragraph 5.2.4.5.)

NOTE 5.5.6.6 – 1

The Delete Request is applicable until actual event stop time (i.e., an ongoing event may be deleted).

5.5.6.6 Wait List Processing

Wait list processing has some of the characteristics of batch processing and some of the characteristics of automatic processing. A set of requests (i.e., the wait list) is processed as a batch. However this processing may be automatically initiated rather than being initiated by the operator. The NCCDS will process requests on the wait list as follows

a. Whenever wait-list processing is executed, the NCCDS shall include all requests on the wait list in a batch scheduling run. If wait list processing is specified to be performed in fully automatic mode (refer to paragraph 5.5.7j.2), the NCCDS shall automatically add events resulting from successfully processed requests to the active schedule. If wait list processing is specified to be performed in semiautomatic mode (refer to paragraph 5.5.7j.3) and any requests were successfully processed, the NCCDS shall notify the operator that the process is complete and provide the operator with all of the capabilities available at the completion of an operator-initiated batch scheduling run. Refer to

paragraph 5.5.3. However, the NCCDS shall not remove unsuccessfully processed requests from the wait list and shall not report such unsuccessful processing via SRMs.

b. Additional conditions apply as follows:

   1. When wait-list processing is specified to be performed periodically (refer to paragraph 5.5.7 j.4) or at a specified future time (refer to paragraph 5.5.7 j.6), the NCCDS shall alert the operator at five minutes prior to the start of wait-list processing. At that time, the operator may inhibit wait-list processing (refer to paragraph 5.5.7 j.1).

   2. The NCCDS shall not execute any further wait list batch scheduling runs until all events resulting from previous wait list processing have been activated or have been discarded by the operator.

   3. The NCCDS may automatically suspend periodic mode wait list processing when there has been no change in conditions (e.g., the deletion of events from the active schedule, or the arrival of TSW updates) that could allow additional events to be scheduled.

c. When the expiration time for a wait listed request is reached, the NCCDS shall remove the request from the wait list and then make a final attempt to schedule the request. If the request was wait listed in response to a wait list request, the expiration time is explicitly specified by the wait list request. Otherwise, the expiration time is based on the customer's default wait listed request expiration interval. Refer to paragraph 5.2.3.3 v.

d. When a wait listed request's requested event start time and event start time tolerances no longer permit the event to be scheduled early enough to allow transmission to the ground terminal at least 5 minutes prior to actual event start time, the NCCDS shall remove the request from the wait list. Refer to paragraph 5.3.4.3b.

e. Whenever any of the above actions cannot be executed due to the operator having inhibited wait-list processing (refer to paragraph 5.5.7j), the NCCDS shall execute all such actions no later than the next periodic execution of wait-list processing after the operator reenables wait-list processing.

5.5.7 Additional Operator Capabilities

As stated in paragraph 5.3.2.4, the NCCDS will provide the operator with capabilities equivalent to those provided to customers via formatted message schedule requests. In addition, the NCCDS shall provide the operator with the capability to

a. Edit a group of requests by incrementing or decrementing the nominal event start times within a selected set of SARs, Alternate SARs, and Replace Requests by the same amount prior to their inclusion in a batch scheduling process.

b. Edit a group of requests by setting the TDRS specifications of all requests within a selected set of SARs, Alternate SARs, and Replace Requests to the same value prior to their inclusion in a batch scheduling process.

c. Edit a group of requests by setting the customer priority of all requests within a selected set of SARs, Alternate SARs, and Replace Requests to the same value prior to their inclusion in a batch scheduling process.

d. Edit a group of events by incrementing or decrementing the event start times within a selected set of active period events by the same amount prior to their inclusion for rescheduling in a batch scheduling process.

e. Edit a group of events by setting the TDRS specifications of all events within a selected set of active period events to the same value prior to their inclusion for rescheduling in a batch scheduling process.

f. Edit a group of events by setting the customer priority of all requests within a selected set of active period events to the same value prior to their inclusion for rescheduling in a batch scheduling process.

g. Delete a selected set of schedule requests.

h. Delete a selected set of scheduled events.

i. Edit the content of any SAR, Alternate SAR, or Replace Request. [Refer to Note 5.5.7.1-1.]

NOTE 5.5.7.1 – 1

The primary use of the request editing capability is to aid in conflict resolution by allowing the operator to modify various parameters beyond their originally specified flexibility limits. Design and/or security considerations may limit the extent of this capability. For example, it is not expected that a garbled request could be edited. It is also not expected that editing would be applied to the parameters that identify the type of request (e.g., delete vs. add) or that are related to customer identification.

j. Control wait-list processing by use of the following options:

1. Inhibit all wait-list processing other than manually initiated single executions of wait-list processing.

2. Specify that Enable wait-list processing is to be performed in fully automatic mode.

3. Specify that Enable wait-list processing is to be performed in semiautomatic mode.

4. Initiate periodic wait-list processing by specifying two parameters:

   (a) The time interval between executions of periodic wait-list processing.

   (b) A specified future time for the initial execution of periodic wait-list processing.

5. Initiate a single execution of wait-list processing to occur immediately.

6. Initiate a single execution of wait-list processing to occur at a specified future time.

5.5.8 Management of Edited Schedule Requests

As stated above, the NCCDS will provide the operator with the capability to edit schedule requests. The following additional requirements apply to the management of edited schedule requests:

a. Whenever the operator edits a schedule request, the NCCDS shall retain the original version of the request.

b. The NCCDS shall provide the operator with the capability to perform additional editing upon a previously edited request.

c. Whenever an edited version of a schedule request exists and the operator is performing any action involving the selection of requests (e.g., selecting requests to be included in a batch scheduling run), the NCCDS shall provide the operator with the option to select either the original version or the edited version of the request. If the request appears anywhere within a chain of requests, the NCCDS shall provide the operator with the capability to select either a version of the chain containing the original version of the request or a version of the chain containing the edited version of the request.

d. The NCCDS shall provide the operator with the capability to delete the edited version of a request without deleting the original version.

e. The original version of a request remains as the primary version until the completion of a scheduling process based on an edited version of a request. At that time, the edited version becomes the primary version. Prior to the completion of a scheduling process based on an edited version of a request, the NCCDS shall interpret any customer schedule request that references another schedule request as applying to the original version of the referenced request. After an edited version of a request is either activated or declined, the NCCDS shall interpret any customer schedule request that references another schedule request as applying to the edited version of the referenced request.

f. In response to any request that involves deletion of the primary version of a request, the NCCDS shall delete all versions of the request.

g. When a chain of requests exists, the interaction of operator editing and new customer requests may result in a large number of permutations of the chain. If necessary to avoid creation of an unmanageably large number of permutations of a chain of requests, the NCCDS may limit the creation of new permutations or may discard previously created permutations. In such cases, the NCCDS shall give precedence to customer requests over NCC operator editing.

5.6 Schedule Dissemination

5.6.1 General

a. Schedule dissemination is the process by which schedule messages are prepared and transmitted by the NCCDS to the SN elements, customers, and customer support facilities. The NCCDS shall send each destination its schedule in the format specified in the applicable ICD. The NCCDS is to send to each destination only that portion of the schedule relevant to its activities. Within each schedule transmission, schedules for each destination shall be transmitted in increasing event start time order. For each destination, there may be multiple variations of the applicable schedule message format. Refer to paragraph 5.3.4.1.

b. Whenever multiple events are deleted by a single operator action, the NCCDS shall transmit any resultant Cancel SHO OPMs (and PTP Delete Command messages when applicable) in ascending order of the event start times of the deleted events. Refer to paragraphs 5.5.7 h. and 5.6.2.2 e.

c. Whenever a SHO's acceptance by a ground terminal is contingent upon the release of resources specified by one or more pending Cancel SHO OPMs, the NCCDS shall not transmit the SHO until all such Cancel SHO OPMs have been transmitted and SHO Status OPMs have been received indicating that the SHOs specified by the Cancel SHO OPMs have been canceled. [Refer to Note 5.6.1-1.]

NOTE 5.6.1 – 1

If a SHO transmission is delayed due to failure to receive a SHO Status OPM, the operator may terminate the transmission and reinitiate transmission of the remaining messages. This can be done in a way that will allow the SHO to be transmitted without waiting for the response to the Cancel SHO OPM. Refer to paragraphs 5.6.6.5 and 5.6.2.3.

5.6.1.1 Distribution Criteria for Schedule Messages

In general, the operator’s control of the schedule transmission process involves specification of a list of events to be transmitted to a list of destinations. As indicated below, the NCCDS provides the operator with a variety of methods to do this. Given such a list of events and assuming that each of the following appears in the list of destinations, the NCCDS is to determine whether a particular event is to be transmitted to a particular destination as follows:

a. STGT. If the event is allocated to a TDRS that is assigned to one of STGT’s SGLTs, the NCCDS shall transmit a SHO to STGT.

b. WSGT. If the event is allocated to a TDRS that is assigned to one of WSGT’s SGLTs, the NCCDS shall transmit a SHO to WSGT. If the event is allocated to a TDRS that is assigned to one of STGT’s SGLTs and an HDRM port has been assigned to one of the event’s return services, the NCCDS shall send an IFL SHO to WSGT.

c. NEST. If the event includes forward, return, or EET services and uses MDM, HDRM, WDISC, analog or video user interface channels, the NCCDS shall transmit an NES to the NEST. [Refer to Note 5.6.1.1-1.]

NOTE 5.6.1.1 – 1

NES messages for playback services are not required. In some cases, this may necessitate operational coordination between the NCC and the NISN.

d. Flexible USM destination. If the event is a flexible event and the destination appears in event's customer's flexible USM distribution list, the NCCDS shall transmit a flexible USM to that destination.

e. Fixed USM destination. If the event is a fixed event and the destination appears in event's customer's fixed USM distribution list, the NCCDS shall transmit a fixed USM to that destination.

f. SDPF. If the event includes forward, return, or EET services and uses an SDPF support user interface channel, the NCCDS shall transmit an NES to SDPF. The content of this NES to be the same as the NES transmitted to the NEST for the same event. [Refer to Note 5.6.1.1-2.]

NOTE 5.6.1.1 – 2

NES messages for playback services are not required. If data is played back to the SDPF, this may necessitate operational coordination the NCC and the SDPF.

g. WDISC. If the event includes forward, return, EET, or playback services and uses a WDISC user interface channel, the NCCDS shall transmit a PTP Event Command message (or messages) to the applicable prime and backup PTPs to configure the machines for the scheduled support.

5.6.2 Dissemination Modes

5.6.2.1 General

The NCCDS shall provide the following five operational modes for the dissemination of schedules:

a. Initial activation transmission.

b. Manual transmission.

c. Semiautomatic transmission.

d. Automatic transmission.

5.6.2.2 Initial Activation Mode Transmission

Upon activation of a batch schedule, the NCCDS will prompt the operator to indicate that the schedule should be transmitted. The NCCDS shall then provide the operator with the option to either immediately execute the transmission, or to delay execution of the transmission until a specified time. The NCCDS shall include the following messages in initial activation mode transmissions

a. USMs for all events that have been added to the schedule.

b. SRMs for all events that have been added to the schedule.

c. SRMs for all events that have been added to the schedule, but that do not fit within the newest available applicable TSWs.

d. SRMs for all requests that were processed within the activated batch but which did not result in events being placed in the schedule (i.e., the "declined" requests).

e. Deletion messages for any previously transmitted events deleted by the batch scheduling process.

5.6.2.3 Manual Mode Transmission and Retransmission

The NCCDS shall provide the operator with the capability to manually initiate transmission or retransmission of schedule messages for selected combinations of destinations and events. The NCCDS shall limit selection of events to active and deleted events (i.e., unactivated batch events are excluded). For each selected event, the NCCDS shall determine the message format to be transmitted based on the selected destination and whether an active or a deleted event is selected. For each combination of destination and event, the NCCDS shall transmit the currently applicable message which may be either a message that has not been previously transmitted or a previously transmitted message that has not been superseded.

5.6.2.4 Semiautomatic Mode Transmission

Semiautomatic mode transmissions are controlled by schedule transmission rule sets (STRSs) entered by the operator. Refer to paragraph 5.6.6.1. When each STRS is executed, the NCCDS shall determine the schedule messages to be included in the transmission. If the STRS specifies the final review option, the NCCDS shall then present the operator with a display indicating the content of the transmission, and provide the operator with the following options:

a. Select additional events to be included in the transmission.

b. Remove events from the transmission.

c. Modify the destinations for the transmission.

d. Immediately execute the transmission.

e. Delay execution of the transmission until a specified time.

f. Cancel the transmission.

5.6.2.5 Automatic Mode Transmission

For a destination and event combination, the NCCDS shall automatically transmit schedule messages whenever

a. A flexible event is frozen and the resultant fixed event would have been selected for transmission by any previous execution of any currently active semiautomatic-mode STRS.

b. An event is added that would have been selected for transmission by any previous execution of any currently active semiautomatic-mode STRS. [Refer to Note 5.6.2.5-1.]

NOTE 5.6.2.5 – 1

All customer schedule transmissions will normally be either initial activation mode transmissions (paragraph 5.6.2.2) or automatic mode update transmissions. Customer events will not normally be transmitted via semiautomatic mode transmissions (paragraph 5.6.2.4). However, each customer destination must be included in at least one semiautomatic-mode STRS in order to enable the automatic mode transmission.

c. Any initial activation mode, manual mode, or semiautomatic mode transmission was not completed due to external conditions (e.g., a communications circuit is down), and the external conditions are subsequently corrected. In the case of initial activation mode transmissions, the automatic mode transmission is to include all messages normally transmitted by the initial activation mode transmission. Refer to paragraph 5.6.2.2.

5.6.3 Time Limit

Except in manual mode, the NCCDS shall not transmit any SHO, USM, or NES less than 5 minutes prior to its event start time. In all other modes, the NCCDS shall alert the operator if an event is selected for transmission less than 5 minutes prior to its event start time. The NCCDS operator will have the capability to transmit PTP Event Command messages between one minute and seventy-two hours before the event start time.

5.6.4 Transmission Segmentation

In order to avoid overwhelming the ground terminals' queues of incoming SHOs, the NCCDS shall be capable of automatically segmenting the transmission of SHOs to the ground terminals. This applies to all transmission modes, and is controlled by parameters specified by the operator. Refer to paragraph 5.6.6.2.

5.6.5 Schedule Status Messages

5.6.5.1 SHOs

The NCCDS shall be capable of receiving status messages from the ground terminals indicating acceptance or rejection of events within the transmitted schedule. [Refer to Note 5.6.5-1.] This

status information is used in displays and alerts presented to the operator, but does not result in any automatic modifications. However, a status message indicating rejection may result in the deletion of an event (refer to paragraph 5.8 b.). It is possible for the ground terminals to send more than one status message for a single schedule message if their capability to support the scheduled activity changes (e.g., equipment failure, changes in acquisition data), or if the NCCDS transmits the same schedule message more than once. For any schedule message transmitted to the ground terminals, the NCCDS shall regard the most recent status message in response to the most recent transmission of the schedule message as the currently applicable response status. [Refer to Note 5.6.5-1.]

NOTE 5.6.5 – 1

The ground terminals may also transmit status messages with regard to Cancel SHO Requests. (Refer to paragraph 5.3.5.)

5.6.5.2 PTP Event Command Messages

The NCCDS shall be capable of receiving status messages from the PTPs indicating acceptance or rejection of PTP Event Command messages. [Refer to Note 5.6.5-2.] This status information is used in displays presented to the operator, but does not result in any automatic modifications.

NOTE 5.6.5 – 2

The PTPs may also transmit status messages with regard to PTP Delete Command messages. (Refer to paragraph 5.3.5.)

5.6.6 Operator Access and Control

5.6.6.1 Semiautomatic Mode Schedule Transmission Rule Sets

The NCCDS shall provide the operator with the capability to enter STRSs used to control semiautomatic mode schedule transmissions.

a. For each STRS, the NCCDS shall provide the operator with the capability to specify the following:

   1. The list of SICs to be included in the transmission.

   2. The types of messages to be included in the transmission. This may be any combination of the following:

      (a) Transmission of applicable schedule messages not previously transmitted.

      (b) Retransmission of applicable schedule messages that have not been superseded.

   3. The destinations of the transmission.

   4. The period of the transmission.

5. The timespan of the transmission. (Example: Period is specified as 12 hours. The timespan is specified as 24 hours. The STRS will execute once per 12 hours and will include 24 hours of schedules for each of the specified spacecraft.)
6. Event start time offset from transmission time. (Example: Offset is specified as 24 hours. The earliest events included in the transmission will have event start times 24 hours later than the time of the start of the transmission.)
7. Time to start or restart execution of the STRS.
8. Whether or not to provide the operator with final review of the schedule messages to be transmitted.
9. The TDRSs for which fixed events are to be included in the transmission.

b. The NCCDS shall provide the operator with the capability to
   1. Modify previously entered STRSs.
   2. Delete previously entered STRSs.
   3. Create new STRSs by copying and editing previously entered STRSs.
   4. Select any STRS for immediate execution.
   5. Suspend execution of a STRS.

c. The NCCDS shall notify the operator whenever a particular combination of SIC, destination, and message type (refer to paragraph 5.6.6.1a.2) is included in more than one active STRS.

d. The NCCDS shall not allow the timespan of an STRS to be less than its period.

5.6.6.2 Transmission Segment Control Parameters

The NCCDS shall provide the operator with the capability to specify the following two parameters:

a. The maximum number of SHOs that can be included in a single transmission segment.

b. The time delay between the transmission of the last SHO in one segment and the transmission of the first SHO in the next segment.

5.6.6.3 Alerts

The NCCDS shall alert the operator whenever any of the following occur:

a. Any transmission is initiated in any mode.

b. Any transmission includes a currently inhibited combination of destination and spacecraft. Refer to paragraph 5.6.6.6.

c. Any ground terminal transmission comes to a pause at the end of a transmission segment.

d. Any ground terminal transmission resumes after an intersegment pause.

e. Any transmission completes normally.

f. There is an indication of transmission failure for any message in any transmission.

g. Any schedule status message or schedule deletion status message indicating any condition other than unqualified acceptance is received.

h. For an event, a schedule status message indicating unqualified acceptance is received after an earlier schedule status message from the same destination that did not indicate unqualified acceptance.

5.6.6.4 Transmission Progress Displays

Following any alert indicating that a transmission has been initiated, the NCCDS shall provide the operator with the option to select an automatically updating display indicating the progress of the transmission.

5.6.6.5 Manual Transmission Control

The NCCDS shall provide the operator with the capability to terminate any ongoing schedule transmission to any selected destination or set of destinations.

5.6.6.6 Transmission Inhibits

The NCCDS shall provide the operator with the capability to inhibit and enable all schedule transmissions to any selected destination or set of destinations for any selected set of spacecraft.

5.6.6.7 Free Text Messages and Printouts

Whenever any event is selected for transmission to a destination and transmission of a formatted message cannot be executed, the NCCDS shall alert the operator and shall provide the operator with the capability to either create and transmit a free-text message, to print out the event in a format suitable for facsimile transmission, or to display the event. The circumstances for which this capability may be applicable include the following:

a. Transmission of playback event to WSGT or to STGT. No SHO is presently defined for tape playbacks. A free-text message can be transmitted.

b. Transmission of playback event to a customer. No USM is presently defined for tape playbacks. A facsimile can be transmitted.

c. Circuit is temporarily down. A facsimile can be transmitted.

5.7 Scheduling Displays

5.7.1 General

In addition to those scheduling displays specified elsewhere in Section 5, the NCCDS will provide the operator with displays of the following:

- TDRS Scheduling Windows.
- Service Planning database.
- Schedule requests.
- Scheduled events.

5.7.2 TDRS Scheduling Windows

The NCCDS shall provide TSW displays at various levels of detail ranging from high level summary displays to the details of individual TSWs. Depending upon the level of detail selected by the operator, these displays shall

a. Clearly distinguish between TSWs for different SICs.

b. Clearly distinguish between TSWs from different TSW sets for the same SIC.

c. Clearly distinguish between TSWs for different TDRSs.

d. Nominally present TSWs sorted in ascending epoch time order.

5.7.3 Service Planning Database

5.7.3.1 SN Resources

The NCCDS shall provide displays of SN Resources at various levels of detail ranging from high level summary displays to detailed displays of individual resources. Depending upon the level of detail selected by the operator, these displays shall

a. Clearly indicate all operator-entered information such as availability and mappings of one resource to another. (Refer to paragraph 5.2.2.)

b. Clearly indicate the resource status as provided by SLR messages. (Refer to paragraph 5.3.7.)

c. For discretely allocated resources, clearly indicate the allocations and availability as a function of time.

d. For incrementally allocated resources, clearly indicate the level of allocation as a function of time.

5.7.3.2 Customer Data

The NCCDS shall provide the operator with the capability to review all of the customer data specified in paragraph 5.2.3.

5.7.3.3 NCCDS Scheduling Control Data

The NCCDS shall provide the operator with the capability to review all of the NCCDS scheduling control data specified in paragraph 5.2.4.

5.7.4 Schedule Requests

5.7.4.1 General

The NCCDS shall provide displays of the schedule requests stored within the NCCDS. The NCCDS shall provide these displays at various levels of detail ranging from high-level summary displays to the detailed content of individual requests and referenced prototype events or SSCs. Depending upon the level of detail selected by the operator, these displays shall

a. Clearly indicate the sender and time of receipt of each request. [Refer to Note 5.7.4.1-1.]

NOTE 5.7.4.1 – 1

The request's User ID parameter identifies the sender of the request.

b. Clearly indicate whether attempts have been made to schedule events in response to each request and whether the attempts were successful.

c. For each request that was not able to be scheduled, clearly identify the conflicts and constraints that prevented the request from being scheduled.

d. Clearly indicate the relationships among requests, such as the relationship of an Alternate SAR to a SAR.

e. Clearly distinguish between requests for different customers.

f. Allow for comparison between the requests actually received from a customer and the nominal level of support for the customer as specified in paragraph 5.2.3.4.

g. Clearly distinguish between types of requests.

h. Clearly indicate the effects of any editing.

i. Nominally present requests sorted in ascending requested event start time order.

j. Provide the operator with the capability to efficiently select individual requests, linked chains of requests, or sets of requests (e.g., select requests for batch scheduling as specified in paragraph 5.5.3.3).

5.7.4.2 Summary Displays

The NCCDS shall provide the operator with a variety of options for requesting displays to summarize schedule requests, including the following:

a. Per TDRS summaries within a specified time interval.

b. Per customer summaries within a specified time interval.

c. Summaries for all customers within a specified time interval.

5.7.4.3 Ad Hoc Request Filters

Within any selected set of requests, the NCCDS shall provide the operator with the capability to locate all individual requests exhibiting an operator-specified set of characteristics. The NCCDS shall provide the operator with the capability to select any combination of characteristics from a list including characteristics such as the following:

a. Specific values of any service parameter.

b. Customer.

c. SN resources.

d. Request level.

5.7.5 Scheduled Events

5.7.5.1 General

The NCCDS shall provide displays of scheduled events at various levels of detail ranging from high level summary displays to the detailed content of individual events and services. Depending upon the level of detail selected by the operator, these displays shall

a. Clearly distinguish between active events and events scheduled by a batch scheduling process but not yet activated.

b. Allow for comparisons between multiple sets of batch-generated schedules. For each customer, these comparisons shall allow the operator to evaluate the schedules in terms of the number of events scheduled relative to the number of events requested and relative to the customer's level-of-support parameters.

   1. For events scheduled in response to schedule requests, clearly indicate the sender and time of receipt of the request that resulted in the scheduling of the event. [Refer to Note 5.7.5.1-1.]

NOTE 5.7.5.1 – 1

The request's User ID parameter identifies the sender of the request.

c. Clearly distinguish between events for different customers.

d. Allow for comparison between the events actually scheduled for a customer and the nominal level of support for the customer as specified in paragraph 5.2.3.4.

e. Clearly distinguish between flexible and fixed events.

f. Nominally present events sorted in ascending event start time order.

g. Clearly indicate which ground terminal is to support the event.

h. Clearly indicate whether the event appears in an SLR's affected SHO list.

i. Clearly indicate events scheduled during TDRS maneuvers.

j. Clearly indicate events affected by TDRS remappings.

k. Clearly indicate whether the event has been transmitted.

l. Clearly indicate the destinations to which the event has been transmitted.

m. Clearly indicate the status returned by each destination.

n. Clearly indicate the SN resources allocated to the event.

o. Provide the operator with the capability to efficiently select individual events or sets of events (e.g., select events for manual mode transmissions as specified in paragraph 5.6.2.3). The capability to select sets of events is to include selection based on combinations of parameters such as SIC, time range, and TDRS.

p. Provide a summary of events that specify WDISC support, including pertinent WDISC-specific information.

q. Provide the operator with the capability to display “least impacting” time at the SGLT level. Least impacting is defined as the minimum number of active events for the given time period and specified duration. The display shall provide the start time, stop time, and number of events for each least impacting interval. The NCCDS shall provide for display of SGLT least impacting times in terms of any combination of:

   1. One or more SGLTs. When more than one is chosen, the result will be a composite of the selected SGLTs (e.g., selecting all SGLTs at a ground terminal displays least impacting time for the entire ground terminal).

   2. Time range, with default being current time to current time + 24 hours. The start and stop time range shall be less than 48 hours.

   3. Minimum duration of interval to display with the default being 10 minutes.

   4. Maximum number of events in the interval with the default being zero (0).

      a) When zero (0) is chosen, the NCCDS shall display one or more intervals with the fewest number of events.

      b) When the maximum number is non-zero, the NCCDS shall display all intervals with the number of events less than or equal to the value specified,

if any, otherwise one or more intervals with the fewest number of events shall be displayed.

5.7.5.2 Summary Displays

The NCCDS shall provide the operator with a variety of options for requesting displays to summarize scheduled events, including the following:

a. Per TDRS summaries within a specified time interval.

b. Per customer summaries within a specified time interval.

c. Summaries for all customers within a specified time interval.

5.7.5.3 Ad Hoc Schedule Filters

Within any selected set of events, the NCCDS shall provide the operator with the capability to locate all individual events exhibiting an operator-specified set of characteristics. The NCCDS shall provide the operator with the capability to select any combination of characteristics from a list including characteristics such as the following:

a. Specific values of any service parameter.

b. Customer.

c. SN resources.

d. Minimum time interval between consecutive uses of a particular resource.

5.7.6 Printouts

For all specified service planning displays, the NCCDS shall provide the operator with the capability to request hardcopy printouts of the displays. For all displays, the NCCDS shall be capable of providing exact paper copies of the on-screen image. [Refer to Note 5.7.6-1.] For some displays, the NCCDS shall provide the operator with option of requesting printouts in a format optimized for print media. [Refer to Notes 5.7.6-2, 3.]

NOTE 5.7.6 – 1

If a color printer is not available or at the operator's option, color-coded on-screen information is to be translated to pattern-coded or shades-of-gray-coded information.

NOTE 5.7.6 – 2

Factors to be considered in optimizing for print media include the differences in aspect ratios between a screen and a sheet of paper, pagination, and whether a screen type font remains readable at the same point size when translated to print.

NOTE 5.7.6 – 3

The displays for which this option is suitable are to be determined by design.

5.8 Event Start/Stop Alerts

The NCCDS will provide operator alerts 5 minutes prior to the start of each event and at the end of each event.

a. At 5 minutes prior to the scheduled start time of each event, the NCCDS shall alert the operator. The alert shall indicate the following:

   1. Whether the ground terminal has rejected the event.

   2. Whether the event's SHO appears in the affected SHO list in the most recent SLR received from STGT or from WSGT.

b. At 5 minutes prior to the scheduled start time of each event, the NCCDS shall delete any event whose primary SHO (i.e., not IFL SHO) has been unconditionally rejected by the ground terminal.

c. At scheduled event stop time of events that were not terminated by the operator or customer, the NCCDS shall alert the operator.

d. When an ongoing event is deleted, the NCCDS shall alert the operator.

5.9 Performance

5.9.1 General

NCCDS performance requirements pertaining to service planning are specified in the following areas:

- Storage capacity.
- Response to schedule requests.
- Scheduling performance.
- Scheduling effectiveness.
- Schedule transmission rate.
- Routine housekeeping.
- TUT generation and remote access.

5.9.2 Storage Capacity

[Refer to Note 5.9.2-1.] The NCCDS shall be capable of storing all service planning data necessary to support the SN customers. The data to be stored includes the following:

a. Customer data for a minimum of 250 customer spacecraft. (Refer to paragraph 5.2.3.) [Refer to Note 5.9.2-2.]

b. 30,000 schedule requests.

c. 20,000 scheduled events.

d. 150,000 TSWs.

NOTE 5.9.2 – 1

The requirements for storage of schedule requests and scheduled events should not be interpreted as requiring independent storage of schedule requests and scheduled events.

NOTE 5.9.2 – 2

CCS is limited to 100 customer spacecraft.

5.9.3 Response to Schedule Requests

The first response returned to a customer in response to a schedule request may vary depending upon a variety of factors including: the type of request, whether the request is valid, and whether the request applies to the forecast period or the active period. Most commonly, the first response will be an SRM. In all cases in which a request is to be queued for batch scheduling, the NCCDS shall return the first response to the customer within 30 seconds of receipt of the request. For requests applicable to automatic schedule update processing, the requirements of paragraph 5.9.4.1 apply.

5.9.4 Scheduling Performance

5.9.4.1 Automatic Scheduling

The performance requirements for automatic scheduling processing vary depending upon the type of request and on whether automatic scheduling lockout is in effect:

a. SAR. Except during applicable periods of automatic scheduling lockout, all system actions taken in response to a SAR shall be completed within 5 seconds of receipt. Upon release of automatic scheduling lockout, SARs queued during the lockout shall be processed at an average rate of no more than 5 seconds per request.

b. Delete Request. Except during applicable periods of automatic scheduling lockout, all system actions taken in response to a Delete Request shall be completed within 5 seconds of receipt. Upon release of automatic scheduling lockout, Delete Requests queued during the lockout shall be processed at an average rate of no more than 5 seconds per request.

c. Replace Request. Except during applicable periods of automatic scheduling lockout, all system actions taken in response to a Replace Request shall be completed within 10 seconds of receipt. Upon release of automatic scheduling lockout, Replace Requests

queued during the lockout shall be processed at an average rate of no more than 10 seconds per request.

5.9.4.2 Batch Scheduling

The NCCDS shall be capable of including a minimum of 5000 SARs in a single batch scheduling run. The NCCDS shall be capable of executing such a batch scheduling run within 6 minutes. [Refer to Note 5.9.4.2-1.]

NOTE 5.9.4.2 – 1

A batch scheduling run is not to be regarded as complete until the system is in a state that would allow another batch scheduling run to be initiated.

5.9.5 Scheduling Effectiveness

Assuming that the level-of-support parameters (refer to paragraph 5.2.3.4) specified by NASA reflect realistic analysis of SN capabilities and that the batch scheduling process comprises one or more batch scheduling runs together with appropriate operator interaction, the NCCDS batch scheduling process shall be capable of generating schedules that correspond to satisfying a minimum of 95 percent of each customer's level-of-support requirements for human flight missions and 90 percent of each customer's level-of-support requirements for all other missions. The NCCDS shall be capable of achieving these results with explicit operator interaction being involved in the satisfaction of a maximum of 20 percent of the customer level-of-support requirements. [Refer to Note 5.9.5-1.]

NOTE 5.9.5 – 1

No scheduling effectiveness requirement applies to automatic update scheduling. It is expected that automatic update scheduling will be less efficient than batch scheduling.

5.9.6 Schedule Transmission Rate

The NCCDS shall be capable of transmitting any combination of SHOs, USMs, and NESs at a maximum rate of at least 10 messages per second. Actual transmission rates will generally be lower due to transmission line capacities and block metering requirements.

5.9.7 Routine Housekeeping

The NCCDS shall be capable of performing routine housekeeping activities (e.g., database backups) while meeting all applicable service planning performance requirements.

5.9.8 TDRSS Unscheduled Time Generation and Remote Access

Given the workload specified in paragraph 9.8 and assuming the active period has a duration of 14 days, the NCCDS shall be capable of generating TUT information for the entire active period

and supporting remote access to this information by all customers within 10 minutes while meeting all other applicable service planning performance requirements.

5.10 Backwards Compatibility

Throughout Section 5, all previous requirements have been written as if there are a single set of customer interface messages and as if all customers will make use of all of the NCCDS scheduling features. However, the NCCDS must be backwards compatible. The NCCDS customers may be partitioned into three classes

a. Baseline customers. The NCCDS 1998 shall provide the capability to support baseline customers using the same set of message formats used by the previous version of the NCCDS. In particular

   1. The schedule deletion notification message is to be used to notify customers of event deletions.

   2. The schedule result message is to identify events through the combination of the SUPIDEN, TDRS, and event start time parameters rather than through use of an event ID.

   3. The schedule delete request message from the customer will identify an event to be deleted through the combination of the SUPIDEN, TDRS, and event start time parameters rather than through use of an event ID.

b. Minimum impact customers. The NCCDS 1998 shall provide the capability to support minimum impact customers using NCCDS 1998 message formats. For those customers who choose to upgrade to the new message formats but without using new capabilities, the NCCDS 1998 shall limit mandatory changes from the previous version of the NCCDS to the following

   1. The schedule result message is used to notify customers of event deletions.

   2. The schedule result message is to identify events through use of an Event ID.

   3. The schedule delete request message from the customer will identify an event to be deleted through use of an Event ID.

   4. The schedule add request message may include parameters not included in the previous version of the schedule add request message.

c. Full support customers. These customers are capable of using the full set of NCCDS 1998 message formats and any (or all) of the new scheduling features such as service duration flexibility.

5.11 TDRSS Unscheduled Time

5.11.1 General

TUT information provides an indication of time periods within the active schedule that are available for the scheduling of additional customer services. The NCCDS will periodically generate TUT information, and then make it available for remote access by customers and for local access by NCC operators. Every time TUT information is generated, it is generated for the entire active period. There will be no incremental updates to previously generated TUT information.

5.11.2 TDRSS Unscheduled Time Generation

The NCCDS shall periodically generate TUT information in accord with parameters specified by the operator and in accord with the algorithms specified in Appendix D of this document. In all cases, the NCCDS shall generate TUT information from the current time to the end of the active period. For each TDRS, the NCCDS shall generate three types of TUT information:

a. Unscheduled SA antenna time period information.

b. Unscheduled MAF or SMAF antenna time periods information.

c. Unscheduled MAR or SMAR link time periods information. [Refer to Note 5.11.2-1.]

NOTE 5.11.2 – 1

Unscheduled SMAF and SMAR time period information applies to TDRS H, I, and J. Unscheduled MAF and MAR time period information applies to earlier TDRSs.

5.11.3 TDRSS Unscheduled Time Storage and Human-Readable Access

5.11.3.1 Storage

Following the above generation of TUT information, the NCCDS shall store it in a format suitable for human-readable access.

5.11.3.2 Human-Readable Access

The NCCDS shall provide an external service that will allow customers to access TUT information in human-readable form. The NCCDS shall also provide an internal version of this service that will allow NCC operators to access TUT information in a similar manner. The NCCDS shall provide for access to TUT information in terms of any combination of:

a. Time range, with default being TUT information for all available times.

b. One or more TDRSs, with default being all TDRSs.

c. One or more types of TUT information (i.e., SA, MAF/SMAF, MAR/SMAR), with default being all types.

5.11.4 Operator Control

The NCCDS will provide the operator with the capability to control the TUT generation process, and to control remote access to TUT information.

a. The NCCDS shall provide the operator with the capability to specify when TUT information is to be generated in terms of a period and/or a time of day.

b. The NCCDS shall provide the operator with the capability to manually initiate an out-of-cycle TUT information generation process.

c. The NCCDS shall provide the operator with the capability to inhibit and reenable TUT generation.

d. The NCCDS shall provide the operator with the capability to inhibit and reenable remote access to TUT information.

Section 6. Service Control

6.1 Introduction

6.1.1 Overview

The NCCDS service control functions include the following:

- Schedule dissemination.
- Acquisition data dissemination.
- Reconfiguration of ongoing services.
- Performance data dissemination.
- Administrative messages.

6.1.2 Schedule Dissemination

The primary mechanism of SN control is schedule dissemination by the NCCDS to the SN elements, to the SN customers, and to various other support elements.

6.1.3 Acquisition Data Dissemination

Acquisition data for some customers is received from the FDF. Other customers not supported by the FDF are responsible for providing acquisition data in the correct format. The NCCDS provides spacecraft vectors to WSGT and STGT for each spacecraft. For a stable orbit, one vector is provided to cover a period from 1 to 24 hours, depending on the stability of the orbit. For unstable orbit periods, vectors are provided in sequence with variable intervals between the epoch times of the vectors. The interval between any two consecutive vectors depends on the maneuver to be executed, but is in no case less than one-half second. WSGT and STGT may reject state vectors, although this should only occur under exceptional conditions.

6.1.4 Reconfiguration of Ongoing Services

The NCC is the SN interface for customer changes to ongoing services. Customers send their requests to the NCC, where they are validated and the appropriate control messages are sent to the SN elements. Provision is made for the SN elements to reject these messages, but this should only occur in exceptional cases.

6.1.5 Performance Data Dissemination

The NCC receives continuous performance data from WSGT and STGT, sorts this data, and sends the relevant portions to those customers who have requested the data.

6.1.6 Administrative Messages

The NCCDS provides the capability for NCC console operators to exchange free-text administrative messages with operators at the WSC.

6.2 Schedule Dissemination

Schedule dissemination is the primary mechanism for the control of the use of SN resources, and as such is properly regarded as a service control function. However, the NCCDS requirements for schedule dissemination are very closely related to the NCCDS requirements for scheduling. For this reason, the detailed schedule dissemination requirements are included in Section 5.

6.3 Acquisition Data Dissemination

6.3.1 General

Acquisition data dissemination is the process by which data required to determine spacecraft and ground facility locations is received, validated, and distributed by the NCCDS. The data handled includes the following:

a. Improved Interrange Vector (IIRV) messages for customer spacecraft and ground facilities received from the FDF.

b. IIRV messages for customer spacecraft received from customers not supported by the FDF.

c. IIRV messages for customer spacecraft and ground facilities transmitted to the WSGT and to the STGT.

d. TDRS IIRV messages received from the FDF.

e. TDRS IIRV messages transmitted to the WSGT to the STGT.

f. Delta-T messages notifying the WSGT and the STGT that the epoch times of the vectors for a specified spacecraft are to be modified.

6.3.2 Receipt of IIRV Messages

6.3.2.1 General

The NCCDS shall be capable of accepting IIRV messages from the FDF and from customers not supported by the FDF.

6.3.2.2 Transmission Termination

Except for IIRV messages received via File Transfer Protocol (FTP), the NCCDS shall regard an IIRV transmission for a particular SIC on a particular communications connection as terminated whenever an IIRV message for another SIC is received on that communications connection, or

when 30 seconds pass without receipt of an IIRV message on that communications connection. The NCCDS shall regard each IIRV message received via FTP as a separate transmission.

6.3.2.3 Vector Validation

The NCCDS will validate incoming vectors.

a. The NCCDS shall discard any incoming IIRV that fails any of the following checks:

   1. The IIRV must be contained within an IIRV message that does not exceed a specified maximum number of IIRVs. For each protocol, this maximum is specified in applicable interface control documentation.

   2. The IIRV must be for a valid SIC and VIC, and all other IIRVs within the same message must be for the same SIC.

   3. The IIRV must be contained within a message whose message class is either 10 or 15.

   4. Vector type must be 1, 2, 4, 5, 6, 7, or 8.

   5. Syntax validation. [Refer to Note 6.3.2.3-1.]

      NOTE 6.3.2.3 – 1

      The details of syntax validation are to be determined by lower level requirements.

   6. Checksum validation. [Refer to Note 6.3.2.3-2.]

      NOTE 6.3.2.3 – 2

      Refer to the IIRV message formats specified by the ICDs for the definition of the checksum parameters.

b. The NCCDS shall discard any incoming type 1 or type 2 IIRV whose position vector has an absolute value of less than 6356 kilometers. [Refer to Note 6.3.2.3-3.]

   NOTE 6.3.2.3 – 3

   The radius of the Earth at the poles is approximately 6356 kilometers.

c. Except for vectors associated with test SICs (refer to paragraph 6.3.7.5), the NCCDS shall discard any incoming type 1 or type 2 IIRV whose epoch time is more than 12 hours in the past or more than 30 days in the future.

d. Except for type 8 vectors associated with permanent Earth stations or with test SICs, the NCCDS shall discard any incoming type 8 IIRV whose epoch time is more than 24 hours in the past or more than 30 days in the future.

e. The NCCDS shall discard any incoming IIRV for a SIC associated with a permanent Earth station and with a vector type other than 8.

f. The NCCDS shall discard any incoming IIRV for a SIC associated with a TDRS and with a vector type other than 1.

6.3.2.4 Maneuver Sequence Validation

Sequences of vectors in specific orders are used to specify the motion of spacecraft during maneuvers. The NCCDS shall discard incoming IIRVs with vector types 2, 4, 5, 6, or 7 when these vectors are not members of a valid maneuver sequence. The NCCDS shall also discard incoming type 8 IIRVs that are immediately preceded or followed by type 6 vectors that are discarded. In order to compensate for the possibility of messages having been received in an order different from the order in which they were originally transmitted, the NCCDS shall validate the order of vectors within maneuver sequences based on ascending epoch times rather than on the order in which the vectors were received. A valid maneuver sequence must

a. Be fully contained within a single transmission. (Refer to paragraph 6.3.2.2.)

b. Be either a landing sequence, or a launch/on-orbit maneuver sequence.

   1. A landing sequence is a type 4 vector followed by two or more type 6 vectors, followed by a type 8 vector, followed by two or more type 6 vectors, and terminated by a type 5 vector.

   2. A launch/on-orbit maneuver sequence is a type 4 vector followed by two or more type 7 vectors, followed by a type 2 vector, followed by two or more type 7 vectors, and terminated by a type 5 vector.

c. Contain at least 7 vectors and at most 800 vectors.

6.3.3 Vector Storage

6.3.3.1 Primary and Secondary Storage

The NCCDS's vector storage area shall be logically partitioned into primary and secondary storage areas. The NCCDS shall provide the operators with the capability to move selected vectors from the primary storage area to the secondary storage area and vice versa. If any vector within a maneuver sequence is selected, the NCCDS shall move all vectors of that sequence. Normally vectors are moved from the primary area to the secondary area when more than one vector applies to the same spacecraft at the same time.

6.3.3.2 Storage of New Vectors

After validation of a newly received vector transmission, the NCCDS shall store the vectors in the primary storage area. If the earliest vector of a newly stored transmission has an epoch time less than or equal that of any vector for the same SIC previously stored in the primary area, the NCCDS shall move all such previously stored vectors to the secondary storage area. If the earliest vector of a newly stored transmission has an epoch time less than or equal that of the last vector in a maneuver sequence for the same SIC previously stored in the primary area, the

NCCDS shall move the entire maneuver sequence to the secondary storage area. The NCCDS will also alert the operator.

6.3.3.3 Vector Transmissions

Except for manual mode transmissions (refer to paragraph 6.3.4.2), the NCCDS shall transmit vectors only from the primary storage area.

6.3.3.4 Retention of Vectors

The NCCDS shall retain vectors associated with permanent Earth stations and with test SICs until these vectors are replaced or are manually deleted by the operator. The NCCDS shall retain all other vectors at least until they are too old for operational use as defined by operator-specifiable control parameters. (Refer to paragraphs 6.3.7.5d.)

6.3.3.5 Epoch Time Changes

The NCCDS shall provide the operator with three options for the manual modification of epoch times of selected stored vectors:

a. Select a vector from primary storage, and have the epoch time change apply only to vectors in primary storage.

    1. The epoch time change is to be applied to all vectors in primary storage for the same SIC and with epoch times equal to or greater than the epoch time of the selected vector.

    2. If the selected vector is a member of a maneuver sequence, the epoch time change is also to be applied to any earlier vectors of the sequence.

    3. If the epoch time is changed to an earlier time and the earliest modified vector now has an epoch time less than or equal to that of any unmodified vectors, such unmodified vectors are to be moved to secondary storage.

b. Select a vector from secondary storage, and have the epoch time change apply only to vectors in secondary storage.

    1. The epoch time change is to be applied to all vectors in secondary storage for the same SIC and with epoch times equal to or greater than the epoch time of the selected vector.

    2. If the selected vector is a member of a maneuver sequence, the epoch time change is also to be applied to any earlier vectors of the sequence.

c. Select a vector from either primary or secondary storage, and have the epoch time change apply to vectors in both primary and secondary storage.

    1. The epoch time change is to be applied to all vectors in primary and secondary storage for the same SIC and with epoch times equal to or greater than the epoch time of the selected vector.

2. If the epoch time of the selected vector lies within a maneuver sequence in either primary or secondary storage, the epoch time change is to be applied to all members of the sequence.

3. If the epoch time is changed to an earlier time and the earliest modified vector in primary storage now has an epoch time less than or equal to that of any unmodified vectors in primary storage, such unmodified vectors are to be moved to secondary storage.

6.3.3.6 Entry, Editing, and Copying

The NCCDS shall provide the operator with the capability to enter new vectors, to edit the content of any vector, and to copy any vector. [Refer to Note 6.3.3.6-1.]

NOTE 6.3.3.6 – 1

The primary use of these capabilities is to aid in testing and to correct unusual operational anomalies. Design and/or security considerations may limit the extent of these capabilities. For example, it is not expected that a garbled vector message could be edited. It is also not expected that editing would be applied to the parameters that identify the type of message or that are related to customer identification.

6.3.3.7 Deletion

The NCCDS shall provide the operator with the capability to delete any selected vector or set of vectors.

6.3.4 Transmission of IIRV Messages

6.3.4.1 General

The NCCDS will transmit IIRV messages to the WSGT and to the STGT. The NCCDS shall request acknowledgment of each IIRV message and shall not transmit any IIRV message to its destination until the acknowledgment process for the previous IIRV message transmitted to that destination is completed. When a transmission is to include vectors for more than one SIC, the NCCDS shall segment the transmission such that all of the vectors for each SIC are transmitted as a contiguous group. For each SIC included within a transmission, the NCCDS shall transmit its vectors in ascending epoch time order. The NCCDS shall provide the following three operational modes for the transmission of IIRVs to the TDRSS ground terminals:

a. Manual.

b. Semiautomatic.

c. Throughput.

6.3.4.2 Manual Mode Transmission

The NCCDS shall provide the operator with the capability to select any set of vectors from either the primary or the secondary storage areas for immediate transmission to WSGT, STGT, or both. If any vector within a maneuver sequence is selected, the NCCDS shall transmit all vectors of that sequence.

6.3.4.3 Semiautomatic Mode Transmission

It is expected that semiautomatic mode transmission will be the most commonly used transmission mode. Semiautomatic mode transmissions are controlled by vector transmission rule sets (VTRSs) entered by the operator. (Refer to paragraph 6.3.7.1.) When each VTRS is executed, the NCCDS shall determine the vectors to be included in the transmission. If the type 4 vector of a maneuver sequence meets the criteria for inclusion in a semiautomatic transmission, the NCCDS shall include the entire maneuver sequence. If the type 4 vector of a maneuver sequence does not meet the criteria for inclusion in a semiautomatic transmission, the NCCDS shall not include the maneuver sequence even if other vectors within the maneuver sequence do meet the criteria for transmission. If the VTRS does not specify the final review option, the NCCDS shall transmit the vectors. If the VTRS specifies the final review option, the NCCDS shall present the operator with a display indicating the content of the transmission and shall provide the operator with the following options:

a. Select additional vectors to be included in the transmission.

b. Remove vectors from the transmission.

c. Modify the destinations for the transmission.

d. Immediately execute the transmission.

e. Delay execution of the transmission until a specified time.

f. Cancel the transmission.

6.3.4.4 Throughput Mode Transmission

6.3.4.4.1 Normal Throughput Mode Transmission

Upon storage of newly received vectors (refer to paragraph 6.3.3.2), the NCCDS shall determine if any of the new vectors would have been selected for transmission by any previous execution of any currently active semiautomatic mode VTRS. Except for vectors qualifying for real-time throughput mode transmission, the NCCDS shall then determine whether operator review (refer to paragraph 6.3.7.1a.9) is required. If operator review is not required, the NCCDS shall immediately initiate transmission of any such vectors. If operator review is required, the NCCDS shall alert the operator and upon request provide the operator with a display of the vectors. The NCCDS shall then provide the operator with the option to either execute or cancel the transmission.

6.3.4.4.2 Real-Time Throughput Mode Transmission

Upon storage of newly received vectors (refer to paragraph 6.3.3.2), the NCCDS shall determine if any of the new vectors would have been selected for transmission by any previous execution of any currently active semiautomatic-mode VTRS and if any of the new vectors has an epoch time less than 7 minutes in the future. If so, the NCCDS shall immediately initiate transmission of any such vectors.

6.3.4.5 Spacecraft State Vector Reception by WSGT and STGT

The NCCDS shall be capable of receiving Spacecraft State Vector Receipt Confirmation OPMs from WSGT and STGT. Such OPMs will also indicate if the vector message was received in error or not. The NCCDS will alert the operator upon receipt of any Spacecraft State Vector Receipt Confirmation OPM that specifies a vector was received in error.

6.3.4.6 Manual Transmission Termination

The NCCDS shall provide the operator with the capability to terminate any ongoing IIRV transmission to any destination.

6.3.4.7 Transmission Inhibits

The NCCDS shall provide the operator with the capability to inhibit and enable all vector transmissions to any selected destination or set of destinations for any selected set of spacecraft.

6.3.5 Delta-T Messages

6.3.5.1 Operator Input

Delta-T messages will generally be transmitted to ground terminals in order to allow the ground terminals to modify their acquisition data in response to short-term Shuttle launch delays. The NCCDS shall provide the operator with the capability to generate Delta-T messages and transmit them to the WSGT and to STGT. The parameters input by the operator include the following:

a. SIC.

b. VIC.

c. Magnitude of the time change in the range 00 hours 00 minutes 01 seconds to 11 hours 59 minutes 59 seconds.

d. Direction of the time change.

e. Destination: WSGT, STGT, or both.

6.3.5.2 Transmission

The NCCDS shall transmit Delta-T messages to the destinations specified by the operator.

6.3.5.3 Delta-T Rejection by WSGT and STGT

The NCCDS shall be capable of receiving Delta-T Adjustment Rejection OPMs from WSGT and STGT. The NCCDS will alert the operator upon receipt of any Delta-T Adjustment Rejection OPM.

6.3.6 Real-Time Mode

6.3.6.1 General

The ground terminals provide a real-time mode for the handling of acquisition data, including Delta-T messages, applicable to either ongoing events or events that will begin in the near future. However, the ground terminals can only provide real-time mode processing for one customer spacecraft per TDRS at a time. The following NCCDS requirements are intended to preclude transmission of any acquisition data for a customer spacecraft while acquisition data for another customer spacecraft is being processed in real-time mode.

6.3.6.2 Interaction of Acquisition Data Transmissions

The NCCDS shall allow newly initiated acquisition data transmissions to interrupt ongoing acquisition data transmissions to the same ground terminal. The NCCDS shall control the interaction of acquisition data transmissions to the same ground terminal according to the following precedence rules:

a. Delta-T message transmissions.

   1. A Delta-T message transmission cannot interrupt any real-time throughput mode transmission.

   2. A Delta-T message transmission can interrupt any other vector transmission at any time except during the transmission of a maneuver sequence.

b. Real-time throughput mode transmissions.

   1. A real-time throughput mode transmission cannot interrupt another real-time throughput mode transmission.

   2. A real-time throughput mode transmission can interrupt any other vector transmission at any time except during the transmission of a maneuver sequence.

c. Normal throughput mode transmissions.

   1. A normal throughput mode transmission cannot interrupt the following:

      (a) Any real-time throughput mode transmission.

      (b) Another normal throughput mode transmission.

   2. A normal throughput mode transmission can interrupt the following:

(a) Any manual mode transmission, but only upon completion of the transmission of all of the vectors for one of the SICs in the transmission.

(b) Any semiautomatic mode transmission, but only upon completion of the transmission of all of the vectors for one of the SICs in the transmission.

d. Manual mode transmissions.

1. A manual mode transmission cannot interrupt the following:

(a) Any real-time throughput mode transmission.

(b) Any normal throughput mode transmission.

(c) Another manual mode transmission.

2. A manual mode transmission can interrupt any semiautomatic mode transmission, but only upon completion of the transmission of all of the vectors for one of the SICs in the transmission.

e. A semiautomatic mode transmission cannot interrupt any other transmission.

6.3.6.3 Real-Time Mode Message

The NCCDS shall be capable of receiving Real-Time Mode OPMs from WSGT and STGT. The NCCDS will alert the operator upon receipt of any Real-Time Mode OPM.

6.3.6.4 Separation of Acquisition Data

The NCCDS shall not transmit a Delta-T message to a ground terminal, or begin or resume transmission of IIRV messages for a particular spacecraft in a particular mode to a ground terminal until all of the following conditions are fulfilled:

a. At least 30 seconds have elapsed since a Delta-T message has been transmitted to the ground terminal.

b. At least 30 seconds have elapsed since an IIRV message has been transmitted to the ground terminal.

c. The ground terminal is in normal mode. Following receipt of a Real-Time Mode OPM indicating entry into real-time mode, normal mode is indicated by any one of the following:

1. Receipt of a Real-Time Mode OPM indicating normal mode.

2. Receipt of a Real-Time Mode OPM indicating real-time sequence interrupted.

3. Expiration of an operator-specified time-out interval started with the receipt of the Real-Time Mode OPM indicating entry into real-time mode. (Refer to paragraph 6.3.7.5g.)

6.3.7 Operator Access and Control

6.3.7.1 Semiautomatic-Mode Vector Transmission Rule Sets

The NCCDS shall provide the operator with the capability to enter VTRSs used to control semiautomatic mode vector transmissions.

a. Each VTRS shall specify the following:

   1. The list of SICs to be included in the transmission.
   2. The types of vectors to be included in the transmission. This may be any combination of the following:
      (a) On-orbit (type 1) vectors.
      (b) Stationary (type 8) vectors not included in maneuver sequences.
      (c) Maneuver sequences.
   3. The destinations of the transmission (i.e., WSGT, STGT, or both).
   4. The period of the transmission.
   5. The timespan of the transmission. (Example: Period is specified as 12 hours. The timespan is specified as 24 hours. The VTRS will execute once per 12 hours and will include 24 hours of vectors for each of the specified spacecraft.)
   6. Epoch time offset from transmission time. (Example: Offset is specified as 24 hours. The earliest vectors included in the transmission will have epoch times 24 hours later than the time of the start of the transmission.)
   7. Time to start or restart execution of the VTRS.
   8. Whether or not to provide the operator with final review of the vectors to be transmitted.
   9. Whether normal throughput mode transmissions associated with the VTRS are subject to operator review.

b. The NCCDS shall provide the operator with the capability to

   1. Review all current VTRSs, including both active and inactive VTRSs.
   2. Modify previously entered VTRSs.
   3. Delete previously entered VTRSs.
   4. Create new VTRSs by copying and editing previously entered VTRSs.
   5. Select any VTRS for immediate execution.
   6. Suspend execution of a VTRS. When a semiautomatic mode VTRS is suspended, throughput mode transmissions associated with the VTRS are also suspended.

c. The NCCDS shall not allow a particular combination of SIC and destination to be included in more than one active VTRS.

d. The NCCDS shall not allow the timespan of a VTRS to be less than its period.

6.3.7.2 Receipt of IIRV Messages

The NCCDS shall alert the operator whenever any of the following occur:

a. An incoming IIRV message transmission terminates. (Refer to paragraph 6.3.2.2.) The alert shall indicate the content of the transmission.

b. An invalid IIRV message or maneuver sequence is received. (Refer to paragraphs 6.3.2.3 and 6.3.2.4.) The alert shall indicate the reason the IIRV message or maneuver sequence is invalid.

6.3.7.3 Vector Storage

6.3.7.3.1 Displays

The NCCDS shall provide the operator with the capability to review the vectors stored within the NCCDS. The NCCDS shall provide these displays at various levels of detail ranging from high-level summary displays to the detailed content of individual vectors. Depending upon the level of detail selected by the operator, these displays shall

a. Clearly distinguish between vectors in the primary and secondary storage areas.

b. Clearly distinguish between vectors for different SICs.

c. Clearly distinguish between types of vectors (i.e., on-orbit, stationary, and maneuver).

d. Clearly indicate the sender and time of receipt of each vector. [Refer to Note 6.3.7.3.2-1.]

NOTE 6.3.7.3.2 – 1

The IIRV's Originator Routing Indicator parameter is to be used to identify the sender of the vector.

e. Clearly indicate the effects of epoch time changes.

f. Clearly indicate overlapping maneuver sequences.

g. Clearly indicate vectors received in overlapping transmissions.

h. Nominally present vectors sorted in ascending epoch time order.

i. Provide the operator with the capability to efficiently select individual vectors or sets of vectors (e.g., select vectors for manual transmission. Refer to paragraph 6.3.4.2.)

6.3.7.3.2 Alerts

a. The NCCDS shall alert the operator whenever the earliest vector of a newly stored transmission has an epoch time less than or equal that of any vector for the same SIC previously stored in the primary area.

b. Whenever vectors are moved from the secondary storage area to the primary storage area, the NCCDS shall alert the operator if the epoch time of any vector for the same SIC in the primary storage area is greater than or equal that of the earliest vector within the moved set and less than or equal that of the latest vector within the moved set.

c. As controlled by operator-specified parameters, the NCCDS shall periodically (refer to paragraph 6.3.7.5e) audit the records of stored and transmitted vectors and alert the operator whenever any of the following occur:

   1. For any SIC, the timespan covered by the vectors in the primary storage area is less than the operator-specified minimum. (Refer to paragraph 6.3.7.5f.1.)

   2. For any SIC, the interval between epoch times of two consecutive vectors in the primary storage area is too large. (Refer to paragraph 6.3.7.5f.2.)

   3. For any SIC, the timespan covered by the vectors transmitted to either of the ground terminals is less than the operator-specified minimum. (Refer to paragraph 6.3.7.5f.3.)

   4. For any SIC, the interval between epoch times of two consecutive vectors transmitted to any ground terminal is too large. (Refer to paragraph 6.3.7.5f.4.)

6.3.7.4 Transmission of Acquisition Data

6.3.7.4.1 Alerts

The NCCDS shall alert the operator whenever any of the following occur:

a. Any IIRV transmission is initiated in any mode.

b. Any IIRV transmission completes normally.

c. There is an indication of transmission failure for any IIRV message in any transmission.

d. A Spacecraft State Vector Rejection OPM is received.

e. There is an indication of transmission failure for any Delta-T message transmission.

f. A Delta-T Adjustment Rejection OPM is received.

g. A Real-Time Mode OPM is received.

6.3.7.4.2 Transmission Progress Display

Following any alert indicating that a transmission has been initiated, the NCCDS shall provide the operator with the option to select an automatically updating display indicating the progress of the transmission.

6.3.7.4.3 Transmission Review Displays

The NCCDS shall provide the operator with the capability to review the vectors and Delta-T messages transmitted to each destination. The NCCDS shall provide these displays at various levels of detail ranging from high-level summary displays to the detailed content of individual vectors. These displays shall

a. Clearly distinguish between vectors for different SICs.

b. Clearly distinguish between types of vectors (i.e., on-orbit, stationary, and maneuver).

c. Clearly indicate the destination and time of transmission for the most recent transmission of each vector to each destination, and for each such transmission of each vector indicate whether there has been an indication of transmission failure and whether a State Vector Rejection OPM was received.

d. For each SIC and destination, clearly indicate the net effect of the vector and Delta-T message transmissions based on the applicable vector handling ground rules applied by the destination. These vector handling ground rules are specified by the applicable interface control documentation.

e. Nominally present vectors sorted in ascending epoch time order.

6.3.7.5 Control Parameters

The NCCDS shall provide the operator with the capability to specify the following parameters:

a. The lists of valid SICs and VICs for which IIRV messages may be received. This includes lists of SICs and VICs for:

   1. Customer spacecraft as specified by the operator as part of the general customer service planning parameters. Refer to paragraph 5.2.3.3. [Refer to Note 6.3.7.5-1.]

      NOTE 6.3.7.5 – 1

      The capability to maintain a separate list of customer spacecraft for acquisition data is not required.

   2. Permanent Earth stations.

   3. TDRSs.

   4. Objects identified with test SICs.

b. The retention criteria for stored vectors, other than permanent Earth station vectors and test vectors. Nominally, the NCCDS will retain vectors for 36 hours after epoch time.

c. The interval to be used for the periodic audit of stored and transmitted vectors. (Refer to paragraph 6.3.7.3.3d.)

d. For each SIC, the parameters used to control the periodic audit of stored and transmitted vectors includes the following:

   1. The minimum timespan to be covered by vectors stored in the primary storage area. Relative to the current time, this includes the following:

      (a) The latest acceptable time for the earliest vector.

      (b) The earliest acceptable time for the latest vector.

   2. Except for permanent Earth station vectors, the maximum acceptable interval between epoch times of two consecutive vectors in the primary storage area.

   3. The minimum timespan to be covered by vectors transmitted to each ground terminal. Relative to the current time, this includes the following:

      (a) The latest acceptable time for the earliest vector.

      (b) The earliest acceptable time for the latest vector.

   4. Except for permanent Earth station vectors, the maximum acceptable interval between epoch times of two consecutive vectors transmitted to each ground terminal.

e. The time-out interval between receipt of a Real-Time Mode OPM indicating entry into real-time mode and subsequent receipt of a Real-Time Mode OPM indicating exit from real-time mode. (Refer to paragraph 6.3.6.4b.2.)

6.3.8 Performance

6.3.8.1 Storage Capacity

6.3.8.1.1 SICs

The NCCDS shall be capable of storing data for a minimum of 500 SICs.

6.3.8.1.2 Vectors

The NCCDS shall have the capacity to store a minimum of 100,000 vectors.

6.3.8.2 Vector Reception, Validation, and Storage

a. For IIRVs received via Transmission Control Protocol/Internet Protocol (TCP/IP) or Nascom 4800 bits/block messages, the NCCDS shall be capable of sustaining reception of IIRV messages at a rate of 4 messages per second. The actual rate may be lower depending upon applicable block metering agreements.

b. Assuming that all vectors within a TCP/IP or Nascom 4800 bits/block transmission are valid, the NCCDS shall validate and store vectors such that the storage of all vectors within a transmission is completed within 0.25 second times the number of vectors in the transmission after the receipt of the last vector in the transmission.

c. Assuming that all vectors within an IIRV message file received via FTP are valid, the NCCDS shall validate and store all vectors within such a file within 15 minutes of receipt.

6.3.8.3 Vector Transmission

Exclusive of time expended while waiting for applicable Nascom 4800 bits/block acknowledgments, the NCCDS shall be capable of transmitting vector messages at a rate of four messages per second.

6.3.8.4 Routine Housekeeping

The NCCDS shall be capable of performing routine housekeeping activities (e.g., database backups) while meeting all applicable acquisition data dissemination performance requirements.

6.4 Reconfiguration of Ongoing Services

6.4.1 General

TDRSS control includes the capability for a customer to reconfigure certain parameters of an ongoing event or initiate special actions to support the event. This real-time control is initiated when a customer sends a Ground Control Message Request (GCMR) to the NCC, or when requested by the operator. The NCCDS shall be capable of concurrently processing one GCMR for each ongoing service. The NCCDS shall maintain records of the current configuration of each TDRSS service throughout the duration of the service. The NCCDS shall provide the NCC console operators with the capability to display the current configuration of each ongoing service. The NCCDS shall use the user ID from a validly received GCMR to determine the routing of customer response messages associated with the processing of that GCMR. The NCCDS shall not provide the capability to process GCMRs pertaining to scheduled ground terminal PM.

6.4.2 TDRSS-Unique GCMRs

6.4.2.1 General

Processing described in this section applies to the following message types:

- User Reacquisition Request.
- Forward Link Sweep Request.
- Forward Link EIRP Reconfiguration Request.

- Doppler Compensation Inhibit Request.
- Expanded User Frequency Uncertainty Request.

6.4.2.2 Receipt

The NCCDS shall be capable of receiving TDRSS-unique GCMRs from an authorized customer or operator.

6.4.2.3 Validation

a. The NCCDS shall reject any TDRSS-unique GCMR that

   1. Does not contain a valid combination of user ID, password, and SUPIDEN.
   2. Does not reference a valid TDRS operational name.
   3. Is received for a customer-service combination that has a GCMR in progress. For WSGT and STGT, the NCCDS shall regard a GCMR as in progress until one of the following occurs:

      (a) Receipt of an OPM Status message in response to a reconfiguration message transmitted to a ground terminal.

      (b) Time-out after an operator-specified number of seconds after acknowledgment of the reconfiguration message. [Refer to Note 6.4.2.3-1.]

NOTE 6.4.2.3 – 1

It is expected that the operator will set this time-out value to approximately 35 seconds. This corresponds to the maximum ground terminal processing time allowed for User Reconfiguration Requests. Less time is allowed for other types of reconfiguration requests.

      (c) Detection of the ground terminal's failure to acknowledge the reconfiguration message.

b. The NCCDS shall reject any User Reacquisition Request that

   1. Is for any service support type other than forward or return.
   2. Is for any link other than those specified in the *Interface Control Document Between the Network Control Center Data System and Mission Operations Center* (i.e., the *MOC ICD*).
   3. Does not apply to an active service as identified by SUPIDEN, TDRS, service support type, and link.
   4. Is for any return service in the IF service configuration.

c. The NCCDS shall reject any Forward Link Sweep Request that

1. Is for any link other than those specified in the *MOC ICD.*
2. Does not apply to an active forward service as identified by SUPIDEN, TDRS, and link.
3. Applies to a service for which Doppler compensation is currently inhibited.

d. The NCCDS shall reject any Forward Link EIRP Reconfiguration Request that

1. Is for any link other than those specified in the *MOC ICD.*
2. Indicates any power mode other than normal or high.
3. Does not apply to an active forward service as identified by SUPIDEN, TDRS and link.

e. The NCCDS shall reject any Doppler Compensation Inhibit Request that

1. Is for any link other than those specified in the *MOC ICD.*
2. Has any compensation inhibit code other than those specified in the *MOC ICD.*
3. Has an SSA Shuttle compensation inhibit code with a non-SSA link, or with a service configuration other than Shuttle.
4. Has the non-SSA Shuttle compensation inhibit code with service configuration for Shuttle and with an SSA link.
5. Does not apply to an active Forward Service, as identified by SUPIDEN, TDRS and link.

f. The NCCDS shall reject any Expanded User Frequency Uncertainty Request that

1. Is for any link other than those specified in the *MOC ICD.*
2. Does not apply to an active return service as identified by SUPIDEN, TDRS, and link.
3. *Applies to a coherent service.*
4. Is for any return service in the IF service configuration.

6.4.2.4 Rejection by the NCCDS

For any customer-requested TDRSS-unique GCMR that is rejected, the NCCDS shall transmit to the customer a Ground Control Message (GCM) status message indicating the reason for rejection. For any operator-requested TDRSS-unique GCMR that is rejected, the NCCDS shall notify the originating operator that the GCMR has been rejected and indicate the reason for rejection.

6.4.2.5 Transmission

For any TDRSS-unique GCMR that is not rejected by the NCCDS, the NCCDS shall format and transmit to the WSGT or to the STGT a corresponding ground control OPM. The NCCDS shall determine whether to transmit the OPM to the WSGT or the STGT based on whether WSGT or STGT is supporting the service to be reconfigured. For customer-requested GCMRs, the NCCDS shall transmit to the customer a GCM Disposition message upon receipt of the WSGT's or the STGT's acknowledgment of the OPM or upon detecting the WSGT's or the STGT's failure to acknowledge the OPM. For customer-requested GCMRs, the NCCDS shall then transmit to the customer a GCM Status message indicating receipt of an OPM Status message from WSGT or from STGT indicating acceptance or rejection, or indicating no OPM Status message received within an operator-specified number of seconds after acknowledgment of the reconfiguration message. Regardless of the order of receipt of messages from the WSGT or the STGT, the NCCDS shall transmit a GCM Disposition to the customer prior to transmitting the GCM Status.

6.4.2.6 Configuration Update

The NCCDS shall update its service records to reflect the requested reconfiguration upon receipt of an OPM Status message indicating acceptance or if no status message is received, after an operator-specified number of seconds after acknowledgment of the reconfiguration message.

6.4.2.7 Operator Alerts

The NCCDS shall present alerts to the operator upon detection of the following conditions:

a. Receipt of a TDRSS-unique GCMR from a customer.

b. Rejection by the NCCDS of a customer-requested TDRSS-unique GCMR.

c. For reconfigurations initiated by the customer, failure to receive OPM status from WSGT or STGT within an operator-specified number of seconds after acknowledgment of the reconfiguration message.

d. For reconfigurations initiated by the operator, failure to receive OPM status from WSGT or STGT within an operator-specified number of seconds after acknowledgment of the reconfiguration message.

e. Receipt of OPM status indicating rejection.

6.4.3 User Reconfiguration GCMR

6.4.3.1 Receipt

The NCCDS shall be capable of receiving User Reconfiguration GCMRs from an authorized customer or operator.

6.4.3.2 Validation

The NCCDS shall reject any User Reconfiguration GCMR that

a. Does not contain a valid combination of User ID, password, and SUPIDEN.

b. Does not reference a valid TDRS operational name.

c. Is received for a customer/service combination that has a GCMR in progress. For WSGT and STGT, the NCCDS shall regard a GCMR as in progress until one of the following occurs:

   1. Receipt of an OPM Status message in response to a reconfiguration message transmitted to a ground terminal.

   2. Time-out after an operator-specified number of seconds after acknowledgment of the reconfiguration message.

   3. Detection of the ground terminal's failure to acknowledge the reconfiguration message.

d. Is not for a forward or return service.

e. Is for any link other than those specified in the *MOC ICD.*

f. Attempts to reconfigure a parameter not defined as reconfigurable for the service's support type and link. [Refer to Note 6.4.3.2-1.]

NOTE 6.4.3.2 – 1

Refer to paragraph 5.2.2.2 f. Specifying that a particular value for a particular parameter is unavailable for scheduling will not prevent reconfiguration of that parameter to that value.

g. Does not apply to an active service as identified by SUPIDEN, TDRS, service support type, and link.

h. For a Shuttle SSA forward service attempts to reconfigure the Shuttle PN Rate Doppler Compensation parameter to NO.

i. Attempts to reconfigure a KaSAR service either to data group 1 or to coherent.

j. Attempts to reconfigure data rate above the maximum rate allowed by the service description.

k. For any interrelated group of parameters, attempts to reconfigure one or more of these parameters in a way that violates ground rules pertaining to the interrelationships of these parameters (e.g., mode and data rate). [Refer to Notes 6.4.3.2-2 and 6.4.3.2 - 3.]

NOTE 6.4.3.2 – 2

This validation specifically rejects (1) SSAR DG2 inversion reconfiguration when data coding not 1, and (2) KuSAR Shuttle mode subcarrier channel reconfiguration that would result in mode 2 and subcarrier 2, or mode 1 and subcarrier 3.

NOTE 6.4.3.2 – 3

There is no requirement to support, or prevent, reconfiguration of the WDISC data rate parameter. Changes to the initial data rate of a WDISC data stream may affect the quality of service.

l. Attempts to reconfigure an SMAR service to right circular polarization (RCP).

6.4.3.3 Rejection by the NCCDS

For any customer-requested User Reconfiguration GCMR that is rejected, the NCCDS shall transmit to the requester a GCM Status message indicating the reason for rejection. For any operator-requested User Reconfiguration GCMR that is rejected, the NCCDS shall notify the originating operator that the GCMR has been rejected and indicate the reason for rejection.

6.4.3.4 Transmission

For any User Reconfiguration GCMR that is not rejected by the NCCDS, the NCCDS shall format and transmit corresponding reconfiguration messages to affected SN elements and customer support facilities. For any parameter left blank in the customer's request, the NCCDS shall fill in the corresponding parameter in the messages transmitted to the NEST and to the customer support facilities with the currently configured value for the parameter. For Reconfiguration Request OPMs transmitted to WSGT and STGT, the NCCDS shall send blanks for parameters left blank in the customer's request. For SA return and SMA return services, reconfigurations may require use of capabilities not provided by the current port address. In such cases, the NCCDS shall automatically effect a reconfiguration to a port address providing the required capabilities.

a. For all valid User Reconfiguration GCMRs containing at least one nonblank parameter, the NCCDS shall format and transmit a Reconfiguration Request OPM to the WSGT or to the STGT. The NCCDS shall determine whether to transmit the OPM to the WSGT or to the STGT based on whether the WSGT or STGT is supporting the service to be reconfigured. For customer-requested GCMRs, the NCCDS shall transmit to the customer a GCM Disposition message upon receipt of the WSGT's or the STGT's acknowledgment of the OPM or upon detecting WSGT's or the STGT's failure to acknowledge the OPM. For customer-requested GCMRs, the NCCDS shall then transmit to the customer a GCM Status message indicating receipt of an OPM Status message from WSGT or from STGT indicating acceptance or rejection, or indicating no OPM Status message received within an operator-specified number of seconds after acknowledgment of the reconfiguration message. Regardless of the order of receipt of messages from the WSGT or the STGT, the NCCDS shall transmit a GCM Disposition to the customer prior to transmitting the GCM Status.

b. For all valid User Reconfiguration GCMRs that involve data rate, data stream ID, or Shuttle mode reconfigurations to services for which the NEST has received a schedule message, the NCCDS shall format and transmit a reconfiguration message to the NEST.

c. For all valid User Reconfiguration GCMRs that involve data rate, data stream ID, or Shuttle mode reconfigurations to return services for which a customer support facility has received a schedule message, the NCCDS shall format and transmit a reconfiguration message to that customer support facility. [Refer to Note 6.4.3.4-1.]

NOTE 6.4.3.4 – 1

Refer to paragraph 5.2.2.7.3. NES messages for SDPF will include only MDM return service data streams. However if other types of data streams have been scheduled within a service, the NRR sent to SDPF may include these other data streams. In general, the destination channel ID for these other data streams will not be applicable to SDPF and will be ignored.

d. For all valid customer-requested User Reconfiguration GCMRs not requiring OPM transmission to WSGT or STGT, the NCCDS shall transmit to the customer a GCM Status message indicating "no problem."

e. For all valid return service GCMRs that reconfigure data rate, data stream ID, subcarrier, or shuttle mode, the Reconfiguration Request OPM transmitted to STGT or WSGT shall automatically include reconfigured DQM setup parameters. (Refer to paragraph 5.2.3.7.)

6.4.3.5 Configuration Update

For valid User Reconfiguration GCMRs requiring OPM transmission to WSGT or to the STGT, the NCCDS shall update its service records to reflect the requested reconfiguration upon receipt of an OPM Status message indicating acceptance or if no status message is received, after an operator-specified number of seconds after acknowledgment of the reconfiguration message.

6.4.3.6 Operator Alerts

The NCCDS shall present alerts to the operator upon detection of the following conditions:

a. Receipt of a User Reconfiguration GCMR from a customer.

b. Rejection by the NCCDS of customer-requested User Reconfiguration GCMR.

c. Transmission of reconfiguration messages involving reconfiguration of data rate, data stream ID, or Shuttle mode.

d. For reconfigurations initiated by the customer, failure to receive status message from WSGT or STGT within an operator-specified number of seconds after acknowledgment of the reconfiguration message.

e. For reconfigurations initiated by the operator, failure to receive status message from WSGT or STGT within an operator-specified number of seconds after acknowledgment of the reconfiguration message.

f. Information alert upon failure to receive status message from NEST within 15 seconds of its acknowledgment of the reconfiguration message.

g. Receipt of status message indicating rejection from any of the following:

1. WSGT.
2. STGT.
3. NEST.

6.4.3.7 Resolution of SN Configuration Inconsistencies

The operator will resolve any SN configuration inconsistencies resulting from a User Reconfiguration GCMR that is not accepted by all affected SN elements.

6.4.4 DELETED

6.4.5 OPM Status

6.4.5.1 Receipt

a. The NCCDS shall be capable of receiving OPM Status messages indicating acceptance from the WSGT and the STGT. The WSGT and the STGT transmit OPM Status messages indicating acceptance for the following NCC-to-WSGT and NCC-to-STGT OPMs:

1. User Reacquisition Request.
2. User Reconfiguration.
3. Forward Link Sweep Request.
4. Forward Link EIRP Reconfiguration.
5. Expanded User Frequency Uncertainty Request.
6. Doppler Compensation Inhibit Request.
7. Cancel SHO Request.

b. The NCCDS shall be capable of receiving OPM Status messages indicating rejection from the WSGT and the STGT. The WSGT and the STGT are capable of transmitting OPM Status messages indicating rejection for any NCC-to-WSGT and NCC-to-STGT OPMs.

6.4.5.2 Validation

The NCCDS shall perform validity checks on each OPM Status message to ensure that the referenced OPM ID, the referenced message class, and the problem code are valid. If the message fails a validity check, within 5 seconds of receipt of the rejection, the NCCDS shall

send an alert to the operator. Valid OPM Status messages shall be processed as indicated in the requirements for transmission of the related NCC-to-WSGT OPMs and NCC-to-STGT OPMs.

6.4.6 Acquisition Failure Notification

a. Receipt. The NCCDS shall be capable of receiving Acquisition Failure Notification OPMs from WSGT and STGT.

b. Validation. The NCCDS shall perform validity checks on each Acquisition Failure Notification OPM to determine whether it is for an authorized customer and for an ongoing service. If the notice fails a validity check, within 5 seconds of receipt of the OPM, the NCCDS shall send an alert to the operator. If the notification is valid, within 10 seconds of receipt of the OPM, the NCCDS shall send an alert to an operator and forward the Acquisition Failure Notification to the customer. The current user ID for the affected SUPIDEN shall determine the routing of the message sent to the customer.

6.5 Performance Data Dissemination

6.5.1 General

Performance data dissemination involves the following processes:

a. Receipt and implementation of User Performance Data Requests from customers.

b. Receipt and storage of ODMs.

c. Reformatting and transmission of this data to customers as User Performance Data messages.

6.5.2 Performance Data Requests

6.5.2.1 Automatic Processing

a. Input. The NCCDS shall be capable of receiving User Performance Data Request messages from customers or from the NCC operator. The requests indicate whether or not to forward ODM data for the SIC specified by the User Performance Data Request.

b. Validation.

1. The NCCDS shall perform syntax validation on each User Performance Data Request message received.

2. If the message fails validation, the NCCDS shall send an alert to the operator. Otherwise, the NCCDS shall send an alert to the operator indicating that a valid User Performance Data Request has been received.

c. Storage and Implementation (Nascom 4800 Bits/Block Customers). The NCCDS shall store the results of a User Performance Data Request and implement that request within 5 seconds of receipt of a valid message. A User Performance Data Request shall remain

in effect until changed via receipt of a new request message or operator request. The NCCDS shall use the user ID from a validly received User Performance Data Request to route the performance data, and any Acquisition Failure Notifications, Time Transfers, or Time Delay Measurements for the involved SIC specified by the User Performance Data Request. If the user ID specified by the User Performance Data Request indicates that data is to be routed to the JSC and the user ID for the MSFC is valid for the involved SIC, the NCCDS shall also use the MSFC user ID to route performance data to MSFC. The NCCDS shall also provide for a default current user ID for each SIC to be used to route Acquisition Failure Notifications, Time Delay Measurements, and Time Transfers in the absence of a User Performance Data Request for that SIC.

d. Storage and Implementation (TCP/IP Customers). The NCCDS shall store the results of a User Performance Data Request and implement that request within 5 seconds of receipt of a valid message. A User Performance Data Request shall remain in effect until the communications connection on which the request was received is closed. The NCCDS shall use the user ID from a validly received User Performance Data Request to route the performance data, and any Acquisition Failure Notifications, Time Transfers, or Time Delay Measurements for the involved SIC specified by the User Performance Data Request. The NCCDS shall not transmit any of these messages for a particular SIC until a communications connection has been established and a valid User Performance Data Request has been received.

6.5.2.2 Operator Display

a. The NCCDS shall provide the operator with the capability to display the status of requests for ODM data for all spacecraft. As an option, the operator shall be able to direct the NCCDS to highlight the ODM request status of a selected spacecraft.

b. The NCCDS shall display the requested data within 5 seconds of completion of operator entry.

6.5.3 Operations Data Messages

6.5.3.1 General

The NCCDS shall receive ODMs and transmit the applicable portions to requesting customers. The NCCDS shall not provide the capability to transmit ODM message information pertaining to scheduled ground terminal PM.

6.5.3.2 Receipt

The NCCDS shall receive ODMs from WSGT and STGT for all ongoing groups of services (SA/SMAR, MA/SMAF, and end-to-end test).

6.5.3.3 Validation of ODM Data

a. Within 2 seconds of receipt of an ODM, the NCC shall validate the TDRS ID for the ODM and the following identification parameters for each service being reported in the ODM:

   1. SUPIDEN.
   2. Service support type.
   3. Service support subtype (for SA/SMAR and end-to-end test ODMs).
   4. SMAR link ID (for SMAR services being reported in SA/SMAR ODMs).
   5. MAR link ID (for return services being reported in MA/SMAF ODMs).

b. If an ODM contains an invalid TDRS ID, within 5 seconds of receipt of the ODM the NCCDS shall

   1. Send an alert to the operator.

c. If an ODM contains a valid TDRS ID but invalid identification parameters for one or more services being reported, within 5 seconds of receipt of the ODM, the NCCDS shall

   1. Send an alert to the operator.

6.5.3.4 Storage of ODM Data

Within 1 second of the validation of an ODM, the data from the new ODM shall be available for transmission processing and for service assurance processing. For transmission purposes, the NCCDS shall be capable of retaining the data from up to 18 ODMs (three service groupings for each of six TDRSs). The NCCDS shall retain the ODM data for each service until validation of a new ODM for that service grouping and TDRS. Additional storage is required for service assurance. (Refer to Section 7.)

6.5.3.5 Transmission

At 5-second intervals while one or more services for a SIC are active and performance data for that SIC is enabled by a User Performance Data Request, the NCCDS shall create and transmit User Performance Data Messages to the currently active User ID, or User IDs, for the SIC. [Refer to Notes 6.5.3.5-1, 2.] When a particular current data packet has been used within a previous User Performance Data Message and is being used again due to the absence of more recent data, the packet shall indicate this fact.

NOTE 6.5.3.5 – 1

More than one user ID can be active for a SIC only when JSC requests performance data and MSFC is a valid user ID for the SIC. (Refer to paragraph 6.5.2.1c.)

NOTE 6.5.3.5 – 2

Each User Performance Data message can contain data for only one TDRS. If services are active on more than one TDRS for the same SIC, there will be multiple User Performance Data messages.

6.5.3.6 Data Quality Monitoring Data Packaging

The NCCDS shall package the User Performance Data messages for all customers based on the ODMs. For specified User IDs, the NCCDS shall also include all applicable DQM data as received within the ODMs.

6.6 Administrative Messages

6.6.1 General

The NCCDS is to provide the capability for all operators to exchange free-text administrative messages with operators at the WSC.

6.6.2 Receipt

Within 30 seconds of receipt of an administrative message, the NCCDS shall notify the applicable operator. Within 5 seconds of the operator's response to this notification, the NCCDS shall present a display of this administrative message.

6.6.3 Entry

The NCCDS shall provide the capability for any operator to enter administrative messages for transmission to the STGT or to the WSGT. After entry of an administrative message, the NCCDS shall provide any operator with the option of storing and transmitting the message or storing the message without transmitting it.

6.6.4 Retrieval

The NCCDS shall provide all operators with the capability to retrieve previously entered administrative messages. Within 5 seconds of operator request, the NCCDS shall present a display of the requested message. After presentation of the retrieved administrative message, the NCCDS shall provide the NCC console operator with the options to edit the message, change the destination of the message, copy the message, and transmit the message. The NCCDS shall allow the operator to exercise these options in any order. The NCCDS shall retain administrative messages such that they remain available for retrieval by the operator for a minimum of 24 hours. The NCCDS shall provide the NCC console operator with the capability to purge any administrative message currently retained.

6.6.5 Transmission

Within 5 seconds of any operator request to transmit an administrative message, the NCCDS shall initiate transmission of the indicated message to its destination.

Section 7. Service Assurance

7.1 Introduction

7.1.1 Network Monitoring

The NCCDS will monitor the ongoing activities of the SN as described in paragraph 7.2. Performance data provided by the TDRSS will be received, processed, and stored automatically. The values of certain performance parameters will be checked by the NCCDS. When a parameter fails these checks, the NCCDS will notify an operator, who will take action to identify the problem. The NCCDS will provide performance data displays to the operator upon request.

7.1.2 Postevent Activities

WSGT and STGT will provide Return Channel Time Delay Measurement and Time Transfer messages at the conclusion of scheduled services for which this support has been requested.

7.1.3 Radio Frequency Interference and Mutual Interference Prediction

The NCCDS will incorporate a capability to predict periods of terrestrial-based radio frequency interference (RFI) with SN customer spacecraft, and to predict periods of mutual interference (MI) among SN customer spacecraft.

7.2 Network Monitoring

7.2.1 Performance Data

7.2.1.1 General

Performance messages from WSGT and STGT summarize the quality of provided service. The performance data shall be used for dynamic displays showing the current quality of support from the various SN elements.

7.2.1.2 ODMs

a. General. There are three types of incoming ODMs: SA/SMAR, MA/SMAF, and end-to-end test. Each ODM is a composite of TDRSS performance data for all active forward and return services of a given type, supported by a single TDRS. The NCCDS shall be capable of processing the maximum number of ODMs transmitted by WSGT and STGT. Requirements for the receipt, validation, and storage of ODM data are defined in paragraph 6.5.3. Requirements for the limit-checking, and displaying of ODM data are defined below.

b. ODM Limits Checks.

1. The parameter LINK STATUS is the key to limits processing of an ODM data packet (i.e., that portion of an ODM that pertains to a specific service). It has three admissible values: ACTIVE, PENDING, and ACQ/REACQ. When LINK STATUS indicates ACTIVE, the NCCDS shall perform additional checks of specific parameter values. [Refer to Notes 7.2.2.2-1, 2.] If any of the checks fail, the NCCDS shall send an alert to an operator.

NOTE 7.2.2.2 – 1

Monitoring of ODM parameter values is limited to the Link Status, Bit Error Rate (BER) Status, and Site Down parameters.

NOTE 7.2.2.2 – 2

LINK STATUS is not applicable to KuSA or KaSA return services in the IF service configuration. Hence, the NCCDS cannot perform any limit processing for these services in the IF service configuration.

c. ODM Detail Displays. Within 5 seconds of the operator request, the NCCDS shall display the data stored from the last ODM for an identified service. [Refer to Note 7.2.2.2-3.] This display shall be updated dynamically once per 5 seconds.

NOTE 7.2.2.2 – 3

This display is not available for end-to-end test ODMs.

7.2.1.3 Composite Performance Data Displays

TDRS Support Summary. Within 5 seconds of request by the operator, the NCCDS shall present a display based on current ODMs that summarizes all ongoing services for a specified TDRS.

7.3 Postevent Activities

7.3.1 Return Channel Time Delay Measurement

The NCCDS shall have the capability to receive, validate, and forward to the customer Return Channel Time Delay Measurement messages within 5 seconds of receipt. If scheduled for a customer, a Return Channel Time Delay Measurement message is sent to the NCCDS by the WSGT or the STGT within 2 minutes of the termination of the service. [Refer to Notes 7.3.1-1, 2.] The Return Channel Time Delay Measurement messages shall be routed to the customer based on the current user ID for the affected SUPIDEN.

NOTE 7.3.1 – 1

The GRGT will not be capable of providing return channel time delay measurement data. If this support is scheduled via GRGT (i.e., WSGT's third SGLT), no Return Channel Time Delay Measurement messages will be provided.

NOTE 7.3.1 – 2

Return channel time delay measurement is not applicable to Ku-band and Ka-band return services in the IF service configuration. If this support is scheduled for an IF service, no Return Channel Time Delay Measurement messages will be provided.

7.3.2 Time Transfer

The NCCDS shall have the capability to receive, validate, and forward to the customer Time Transfer messages within 5 seconds of receipt. If scheduled for a customer, a Time Transfer message is sent to the NCCDS by the STGT or the WSGT within 1 minute of the termination of the service. The Time Transfer messages shall be routed to the customer based on the current user ID for the affected SUPIDEN.

NOTE 7.3.2 – 1

Time Transfer messages are not applicable if the associated return service is in the IF service configuration.

7.4 Radio Frequency Interference and Mutual Interference Prediction

The NCCDS shall incorporate a capability to predict periods of terrestrial-based RFI with SN customer spacecraft, and a capability to predict periods of MI among SN customer spacecraft. The RFI prediction capability depends upon customer spacecraft IIRVs and TDRS IIRVs. The MI prediction capability depends upon these IIRVs and in addition depends upon SN schedules generated by the NCCDS. The NCCDS shall provide the operator with the capability to control the use of scheduling information by the MI prediction process such that MI predictions can be based on the active schedule, or can be based on the active schedule and on a selected batch schedule that has not yet been activated. The NCCDS will provide the RFI and MI prediction capabilities via incorporation of the Automated Conflict Resolution System (ACRS)/TDRSS Look Angle System (TLAS) as a subsystem of the NCCDS. The ACRS requirements are specified in the *Network Control Center (NCC) Communications Link Analysis and Simulation System (CLASS) Automated Conflict Resolution System (ACRS)/TDRSS Look Angle System (TLAS) Requirements*, 534-ACRSTLASR-CLASS.

Section 8. Service Accounting

8.1 Introduction

8.1.1 General

Service Accounting provides management with information on the quantity and quality of service provided to customers by the SN, and effectiveness of the network. The NCC will collect and store information in sufficient detail to provide an audit trail of network activities, and provide reports on network activities and conditions.

8.1.2 Data Collection

The data collected and stored is limited to that data available in operational message traffic between the NCC and the SN elements, the customer support facilities, and customers; and to data related to the NCCDS's interaction with the NCC operators. Sufficient data will be collected from these sources to permit an accurate reconstruction of the history of network activities for any specified period of time.

8.1.3 Reports

The NCCDS will provide both predefined and operator defined accounting and management reports based on the collected data.

8.2 Historical Log

8.2.1 General

The NCCDS shall maintain a log of all data relating to SN services. [Refer to Note 8.2.1-1.] The log shall be used to prepare management reports, evaluate SN performance, monitor network trends, and account for reimbursable service.

NOTE 8.2.1 – 1

The Service Accounting requirements specified herein are worded as if the logged data were to be accumulated at a single physical point within the system. This has been done only to simplify the wording of these requirements. The actual data accumulation method is to be determined by design, and may involve accumulation of data at multiple points within the system.

8.2.2 Data Accumulation

8.2.2.1 General

a. The NCCDS shall log the following:

   1. External messages.

   2. Operator alerts and entries.

b. The NCCDS shall append to each log entry the Coordinated Universal Time (UTC) of its

   1. Receipt,

   2. Occurrence, or

   3. Transmission.

8.2.2.2 External Messages

a. The NCCDS shall log all messages received from, or transmitted to, elements outside the NCC, except for those incoming messages that fail communication protocol checks. This consists of all the messages listed in Appendix A.

b. Additional requirements for logging messages are specified elsewhere within this document.

8.2.2.3 Operator Alerts and Inputs

The NCCDS shall log all alerts to NCC operators and all inputs by NCC operators, including free-text comments and entries to acknowledge action alerts.

8.2.2.4 Scheduling

The NCCDS shall record data sufficient to permit an accounting of all activity relevant to scheduling. [Refer to Note 8.2.2.5-1.] This data includes the following:

a. All schedule requests, together with sender and time of receipt. [Refer to Note 8.2.2.5-2.]

b. All operator editing of scheduled requests.

c. All schedule result messages.

d. All schedule messages and responses.

e. The time at which each scheduling attempt is made, the form of the request used for each attempt, and an indication of which attempts were successful.

f. All operator-selected data applicable to each scheduling batch run.

g. Rescheduling activity regardless of cause, but specifically including revised TSWs, equipment status changes, and activity initiated by other customers.

NOTE 8.2.2.5 – 1

The preceding paragraphs provide the basic requirements for logging of messages, operator alerts, and operator inputs. These log entries serve as the basis for meeting the requirements of this paragraph. However, any other data needed to meet the requirements of this paragraph must also be recorded.

NOTE 8.2.2.5 – 2

The User ID parameter within the request identifies the sender of the request.

8.2.3 Data Retrieval

8.2.3.1 General

The NCCDS shall provide for retrieval from the historical log of entries matching a specified value, one value within a list of specified values, or one value within a specified range of values for each member of any specified subset of the following characteristics: log time, sender, destination, message type, message type and class, SIC or SUPIDEN, TDRS, TDRSS service, and User ID. [Refer to Note 8.2.3.1-1.]

NOTE 8.2.3.1 – 1

The User ID parameter within the request identifies the sender of the request.

8.2.3.2 Data Related to Schedule Requests

When provided with identification of a schedule add request, the NCCDS shall be capable of retrieving all of the data related to the identified request (refer to paragraph 8.2.2.5). For successfully scheduled requests, the NCCDS shall be capable of retrieving all related data when provided with identification of the scheduled event.

8.2.3.3 Output

The NCCDS shall provide the operator with the capability to designate the physical form of service accounting output. From the logged data, the NCCDS shall be capable of generating the following:

a. Hardcopy output.

b. Machine-readable output to be used to generate hardcopy output at a later time.

8.2.4 Data Retention

The NCC shall retain the logged data for a minimum of 90 days following the applicable operational day.

8.3 Report Generator

It is not possible at this time to identify all the reports that may be required through the operational life of the NCC. In addition, the NCCDS should preclude obsolescence by allowing maximum flexibility. Both of these items can be successfully addressed with the inclusion of a generalized report generator in the NCCDS. To provide the report generation function, the NCCDS shall

a. Produce reports with the format and content specified by a stored definition for that report.

b. Be capable of generating a defined report at a specified time interval or date.

c. Maintain the definitions for up to 200 reports.

d. Provide the operator with the capability to define new reports and the method for commanding report generation, and to modify or delete defined reports.

e. Have the capability to access logged data to generate a previously defined report.

f. Provide the operator defining a new report the capability to create, store, view, and modify variables to be used in report generation. These variables shall be limited to those extracted or derived from the data available within the NCCDS, including the values of other defined variables.

g. Maintain a directory of all defined reports and variables. The directory shall be available to the operator to locate a desired report or variable in the file. Each directory listing shall contain the name of the report or variable, date defined, person defining it, date modified, and person modifying it.

8.4 Reports

8.4.1 General

The NCCDS shall be capable of generating the management and operations reports defined below. The data used as the basis for these reports may be retrieved from the historical log. The generation of these reports may be performed using the general report generator described in paragraph 8.3. If the generation of any of these reports is performed using the general report generator, their definitions shall be modifiable only by the DB and, in addition, the NCCDS capacity for storing report definitions shall be increased accordingly.

8.4.2 Management Reports

8.4.2.1 General

a. The NCCDS shall generate reports to provide NASA management with the information necessary to assess the following:

   1. The performance of the SN.

   2. The quality of services provided to customers.

b. These reports shall include the following:

   1. Customer support summaries.

   2. Network service summaries.

   3. Network performance data summary.

8.4.2.2 Customer Support Summaries

The NCCDS shall generate daily reports about each customer, summarizing all services scheduled, deleted, or provided during the previous operating day. The information reported will support the reimbursement and Mission Requirements Request (MRR) compliance assessment activities of NASA management.

8.4.2.3 Network Service Summaries

The NCCDS shall generate a daily report for each service, summarizing the quantity and quality of service requested, scheduled, and provided during the previous operating day.

8.4.2.4 Network Performance Data Summary

The NCCDS shall generate performance data summary reports that summarize the quality of service provided by WSGT and STGT. . The reports will be used for long-term trend analysis, and performance evaluation.

8.5 Message Review

The NCCDS shall provide for the display of formatted log entries retrieved from the external message log together with the time applied by the NCCDS when the data was logged. Such displays shall be produced in response to the request of the operator. Message data shall be displayed in alphanumerics. The operator shall be capable of selecting data according to the characteristics listed in paragraph 8.2.3.1. Use of this function shall not require the operator to enter a stored definition into the general report generator function. For at least 2 hours after the data is logged, individual log entries retrieved in this manner shall be available to the operator within 25 seconds.

Section 9. System Operation

9.1 Introduction

The NCCDS system operation requirements are partitioned into the following areas:

- NCC console operator positions.
- Operator/System interface.
- External communications.
- NCCDS control.
- NCC testing.
- NCCDS workload capacity.
- Response time requirements.

9.2 NCC Console Operator Positions

9.2.1 General

The NCCDS shall provide for two types of console operator positions:

- The most privileged operator position.
- Positions controlled by the most privileged operator.

9.2.2 Most Privileged Operator Position

The NCCDS shall restrict the functions specified in paragraph 9.2 to the most privileged operator.

9.2.3 Positions Controlled by The Most Privileged Operator

The NCCDS provides the most privileged operator with the capability to control the capabilities available to all other operators:

a. The NCCDS shall provide the most privileged operator with the capability to define a minimum of 100 operator groups.

b. With the exception of any alerts and operator entries that are restricted to the most privileged operator, the NCCDS shall provide the most privileged operator with the capability to associate any alert and any operator entry or functionally coherent group of operator entries with any operator group. Individual alerts and operator entries can be concurrently associated with many operator groups.

c. For each combination of operator group and alert, the NCCDS shall provide the most privileged operator with the capability to specify whether that alert is to be presented to that operator group as an information alert or as an action alert.

d. For each individual operator, the NCCDS shall provide the most privileged operator with the capability to specify the operator groups in which that operator is a member.

e. Unless otherwise specified, the information presentation functions of all displays may be accessed by all operators. However, the data entry functions of each display will be controlled as specified above.

f. Within this document whenever "operator" is used in association with an alert or entry function, it is intended that the NCCDS will provide the most privileged operator with the capability to associate the alert or entry with an operator group defined by that operator.

9.3 Operator/System Interface

9.3.1 General

The operator/system interface refers to the interaction between the NCCDS and its operators. [Refer to Note 9.3.1-1.] Although each class of operators will have its own unique functions, there will be commonality in the consoles, displays, alerts, and reports provided to and entries expected from operators. This section addresses the common aspects of their interface with the NCCDS.

NOTE 9.3.1 – 1

The operator/system interface requirements specified herein apply to the operators who perform the functions specified elsewhere in this document. Depending upon the hardware selected for the NCCDS, there may also be computer operators who perform lower-level system functions. The operator/system interface requirements do not apply to the interface with these computer operators (if any).

9.3.2 Workstations

9.3.2.1 General

The NCC design shall provide workstations for all categories of NCC console operators to perform their assigned functions. [Refer to Note 9.3.2.1-1.]

NOTE 9.3.2.1 – 1

Herein, the term "workstation" is used in accord with its general meaning. In terms of specific types of devices, this use of "workstation" should not be interpreted as precluding a design that would use terminals rather than workstations.

9.3.2.2 Workstation Features

Each workstation shall have the following common functions/features:

a. Data display and data entry shall provide the means for NCC operators to interact with the NCCDS for purposes of viewing tabular, dynamic, and static presentations and for entering data parameters required for the specific display functions.

b. Audio and visual alerts shall be provided to direct the operator's attention to system status messages, anomalous conditions, or to specific situations requiring operator intervention. The audio alert, associated with an action alert, is used as an aid in attracting attention to the visual alert when the NCC operator is not viewing the display device. The audio alert device shall be controllable by the NCC console operator, including both the on/off and volume functions. The visual alerts are described in paragraph 9.3.4.

c. Function selection capabilities shall be provided to operators for often used functions common to all positions. Examples of these capabilities include the following:

   1. Scrolling within windows.

   2. Hardcopy request.

   3. Alert acknowledge.

   4. Enter.

   5. Place cursor at any selected screen position.

d. A special hardware feature shall provide for rapid, nonkeyed data entry and nonkeyed function selection. This feature (e.g., a mouse) provides a faster means of option selection from multiple choices during high volumes of data entry.

e. The operator-controlled capability to partition the screen into many windows. The general operator capabilities associated with these windows include the following:

   1. Request update of the information in any window without affecting the content of the others.

   2. Resize window when appropriate for the window’s content.

   3. Close each window.

f. Basic text editing capabilities (e.g., copy, cut, and paste).

g. Permanent recording of display capability shall be provided to the operator for making a hardcopy of the entire screen content at any given time. These copies shall be in the same proportions as the screen layout. The console shall not be locked out for more than 1 second during the copy process. Hardcopy of the screen content shall be available to the NCC console operator within an average of 60 seconds after entry of the request.

h. Provide an interface with the NCC closed-circuit television (CCTV) and video distribution systems such that:

   1. Displays generated by NCC systems other than the NCCDS can be viewed by NCC console operators.

   2. Displays generated by the NCCDS can be viewed at other NCC positions.

9.3.3 Displays

9.3.3.1 General

The NCCDS shall provide each category of NCC console operators with the specific displays needed to perform the operator's functions. Unless the requirements for a specific display explicitly exclude other operators, the NCCDS shall permit all operators to access the data presentation functions of that display.

9.3.3.2 Categories

The NCCDS shall provide static and dynamic displays that may be either tabular or graphic. Color graphics shall be used for displaying system data in a pictorial form to include the combination of both graphics and alphanumeric characters. Each display shall be designed to meet the needs of the NCC console operator designated as the primary user of that display.

9.3.3.3 Display Interrelationships

The NCCDS shall structure the collection of displays provided for each NCC console operator group such that from each display the operator can easily access other logically related displays. Some displays may be accessible only after accessing one or more other displays. For access to displays not logically related to a current display, the NCCDS shall provide the operator with access methods such as pull-down menus or keyboard shortcuts.

9.3.3.4 Common Display Features

All NCC console operator displays shall provide the following common features:

a. Presentation of UTC.

b. Capability to present operator-selected windows.

c. Capability to present action alerts.

d. Capability to present information alerts.

e. Capability to inform and prompt the operator.

9.3.3.5 Update Rates

The NCCDS shall provide each dynamic display to NCC console operators as follows:

a. ODM updates shall be displayed within 5 seconds of receipt of a new ODM.

b. Updates to other dynamic displays shall be displayed within 5 seconds of entry of the updated data in the NCCDS.

9.3.3.6 Operator Actions

a. Common features. All data entry displays produced by the NCCDS shall include prompts, aids, and other features to assist the operator in the data entry process. All data entered using such displays shall be validated by the NCCDS prior to performing or initiating the requested NCCDS function.

b. Operator data entry. The NCCDS shall provide a data entry display designed to perform each specific operator function noted in sections 5, 6, 7, 8, or 9.

c. Operator-initiated actions on behalf of customers and SN elements. For each NCCDS function that may be initiated by an incoming high-speed data message, the NCCDS shall provide the NCC console operator the capability to initiate that function. Input of data (e.g., ODMs) is distinct from initiation of NCCDS functions, and is excluded from this capability.

9.3.3.7 Color Coding

Whenever a display uses color coding to present information, the NCCDS shall provide redundant coding of such information using techniques such as pattern-coding or shades-of-gray-coding.

9.3.4 Alerts

9.3.4.1 General

The NCCDS shall send alerts to NCC console operators when exceptional circumstances arise that require human intervention, or when information from the operator is necessary for proper system functioning. The NCCDS shall selectively send alerts to the NCC console operators, based on their functions and the condition detected. [Refer to Note 9.3.4.1-1.] Unless otherwise specified, the NCCDS shall send all alerts to the appropriate NCC console operator within 5 seconds of receipt of the message or determination of the condition requiring an alert. [Refer to Note 9.3.4.1-2.]

NOTE 9.3.4.1 – 1

For each alert, the most privileged operator determines which operator groups are to receive the alert. For each combination of operator group and alert, the most privileged operator determines whether the alert is to be presented as an information alert or as an action alert. Refer to paragraph 9.2.3.

NOTE 9.3.4.1 – 2

Some of the NCCDS requirements will be fulfilled via integration of commercial off-the-shelf (COTS) products. Many of these COTS products will include operator notification mechanisms similar to the alert mechanism specified herein. In such cases, it is not intended that the COTS product be extensively modified to achieve exact compliance with these alert requirements.

9.3.4.2 Two Types of Alert

The NCCDS shall provide two types of alert messages to the NCC console operators:

a. Information alert. Information alerts are used to present information to NCC console operators, and do not require that NCC console operators take any action in response. Once it has been presented, an individual information alert shall remain visible on the console display for a minimum of 5 seconds. Whenever information alerts are generated more rapidly than once every 5 seconds, the NCCDS shall queue these information alerts for subsequent display. Each information alert shall be presented together with its time of generation.

b. Action alert. Action alerts are used to indicate to NCC console operators that conditions exist for which operational procedures require that the operator take some action. All action alerts must be acknowledged by the NCC console operator. Once it has been presented, an individual action alert shall remain visible on the console display until acknowledged. Whenever action alerts are generated more rapidly than they are acknowledged, the NCCDS shall queue these action alerts for subsequent display in order of generation. An audio signal shall be generated upon queuing each alert. Each action alert shall be presented with its time of generation.

9.3.4.3 Acknowledgment of Action Alerts

The NCCDS shall provide the NCC console operator with the capability to acknowledge action alerts through a single entry. On receipt of the acknowledgment, within 1 second the NCCDS shall present the next queued action alert (if any). Some action alerts may indicate to the NCC console operator that additional information is available to be viewed. Whenever such an alert is present, the NCCDS shall provide the NCC console operator with the capability to retrieve this information immediately or at a later time.

9.3.4.4 Pending Alerts

a. The NCCDS shall provide NCC console operators with the capability to display all information alerts queued for their respective consoles. The display of each alert shall include its time of generation. After an information alert has been presented in this manner, the NCCDS shall not present the same alert in the alert message area.

b. The NCCDS shall provide NCC console operators with the capability to display all unacknowledged action alerts queued for their respective consoles. The display of each alert shall include its time of generation and an indication of whether additional information associated with the alert is available for viewing by the NCC console operator. For each displayed action alert, the NCC console operator shall be provided with two options: acknowledge only, or acknowledge and request display of any associated information.

c. The NCCDS shall provide each console operator with the capability to review previously acknowledged action alerts presented to that operator since the most recent log-on.

9.3.4.5 Repetitive Alerts

The NCCDS shall respond to a repetitive action or information alert situation as follows:

a. At the first occurrence of a condition requiring an alert, the specified action or information alert shall be generated.

b. Any recurrence of an alert condition within 60 seconds shall not result in the generation of an alert at that time, but rather in the generation of an information alert 60 seconds after the previous alert. This information alert shall indicate the number of recurrences within the previous 60 seconds.

c. If for 60 seconds a previously recurring condition ceases, any further occurrence of the condition shall be handled as in paragraph a.

9.3.5 Reports

The NCC console operators shall have the capability to generate the reports defined for their position using a data entry display specifically designed for that purpose.

9.3.6 Operator Identification

9.3.6.1 Operators

The NCCDS shall provide the NCC console operators with the capability of identifying themselves to the NCCDS.

9.3.6.2 Log-On

The NCCDS shall validate log-on requests using records of authorized operators and passwords. The NCCDS shall reject a log-on request if the individual requesting access cannot be identified by name and password. The NCCDS shall not respond to any other entry or request from a NCC console until a valid log-on is received. After an operator's log-on request is validated, the NCCDS shall allow the operator access to all alerts and all operator entry functions associated with all operator groups in which that operator is a member. Upon request, the NCCDS shall

provide the operator with a list of all operator groups in which that operator is a member. [Refer to Note 9.3.6.4-1.]

NOTE 9.3.6.4 – 1

If an individual operator needs to be able to perform different operator functions at different times, that operator may be assigned more than one account.

9.3.6.3 Log-Off

The NCCDS shall provide the operator with the capability to log-off. Upon entry of an operator log-off from a particular console, the NCCDS shall disable all operator functions, other than log-on, at that console. Upon log-off, the NCCDS shall retain work-in-progress (e.g., batch schedules) initiated by the operator and allow this work-in-progress to be accessed by other operators with appropriate group membership.

9.3.6.4 Alert Routing and Filtering

The NCCDS shall route each alert only to those operators who have membership in the operator group associated with the alert. If an alert is associated with more than one operator group and an operator has membership in more than one of these operator groups, the NCCDS shall send only one copy of the alert to the operator. If an alert is specified as an action alert for one operator group and as an information alert for another operator group and an operator has membership in both of these groups, the NCCDS shall send the alert to that operator as an action alert. In addition, the NCCDS shall provide each operator with the capability to specify a combination of TDRSs and customer SICs to be used to filter alerts. Subsequently, the NCCDS shall present alerts to that operator only for the specified combination of TDRSs and SICs.

9.3.6.5 Coverage

At all times, the NCCDS shall maintain a record of currently logged-on operators..

9.3.7 Interactive Performance

Except where otherwise specified, the NCCDS is to respond to NCC operator actions as appropriate to the task and within the following response time guidelines:

a. For simple input interactions such as typed data entry, mouse/pointer actions, direct manipulation, and animation, the normal NCCDS display response shall appear to be instantaneous. Response time in such cases shall not exceed 150 milliseconds.

b. For simple commands and intermediate steps in a process, such as paging, simple error checking, and copying and pasting text, the NCCDS display response shall not exceed two seconds.

c. For tasks that require more than two seconds, the NCCDS shall provide user feedback indicating system status, the estimated time to complete the task (if one can be determined), and the progress of the task.

d. For complex tasks, the NCCDS display response should not exceed 15 seconds. For a complex task that may require more than 15 seconds to complete, the NCCDS shall provide the ability to terminate the task during execution or the ability to execute other tasks concurrently.

9.4 External Communications

9.4.1 Introduction

To perform the functions of service planning, control, and assurance for the SN, the NCC will require the capability to communicate with other SN elements and customers. The NCC will have the capability to communicate by formatted messages, secure facsimile, and voice. The primary mode of communication will be via formatted messages. Voice and secure datafax will provide supplementary and/or backup communications capability. The NCCDS is not required to ensure communications with external entities at higher levels of performance and reliability than are permitted by use of these government-furnished communications media. Message-related performance requirements will involve the time of receipt by the NCCDS rather than the time of transmission by the external entity, and the time of initiation of transmission by the NCCDS, rather than the time of receipt by the external entity.

9.4.2 External Formatted Messages

9.4.2.1 General

The NCCDS shall have the capability of receiving and transmitting (both automatically and in response to operator request) formatted messages. A list of the formatted messages to be exchanged between the NCCDS and the SN elements, and between the NCCDS and the SN customers is contained in Appendix A. For each external interface, the NCCDS electronic communications shall follow the protocol requirements indicated by the ICD or Interface Agreement (IA) applicable to that interface. For some of these interfaces, the NCCDS will follow standard Transmission Control Protocol/Internet Protocol (TCP/IP) or standard File Transfer Protocol (FTP). For the remaining interfaces, the NCCDS will follow the protocol associated with the Nascom 4800 bits/block messages, as defined in the *Nascom Interface Standard for Digital Data Transmission (NISDDT)*. [Refer to Note 9.4.2.1-1.]

NOTE 9.4.2.1 – 1

On some of the external interfaces, the Nascom 4800 bit blocks will enter and leave the NCCDS encapsulated in User Datagram Protocol (UDP) datagrams. For incoming messages, all requirements stated herein pertain to the 4800 bit block after it has been extracted from the datagram. For outgoing messages, all requirements stated herein pertain to the 4800 bit block before it is encapsulated in the datagram.

9.4.2.1.1 General Message Handling Requirements

Those NCCDS requirements, including performance requirements, that are applicable to specific messages are specified throughout this document and in applicable interface documentation. General requirements for the handling of messages applicable to both TCP/IP message exchange and Nascom 4800 bits/block message exchange are as follows:

a. As specified in preceding sections, the NCCDS will have the capability to detect invalid messages, alert the operator, and selectively log the message.

b. The NCCDS shall automatically route correctly received incoming messages to the appropriate functions/positions.

c. The NCCDS shall be capable of controlling the logging and delogging of all incoming and outgoing messages from a central point under operator control. Specific logging requirements are contained in Section 8.

d. For each incoming message listed in Appendix A, the NCCDS will provide a protocol mechanism applicable to the receipt of that message. These protocol mechanisms will be identified in the applicable ICDs. If any message is received via a protocol mechanism not applicable to that message, the message is invalid even if it would have been valid had it been received via the proper protocol mechanism. For each protocol mechanism, the NCCDS shall dispose of such messages in a manner consistent with the disposition of other invalid messages received via the same protocol mechanism. This will generally include alerting the NCC operator, and may include termination of the external communications connection.

9.4.2.1.2 General Communications Performance Indicators

The NCCDS will have the capability to assure the availability of each external communications path.

a. For both TCP/IP message exchange and Nascom 4800 bits/block message exchange, the NCCDS shall provide the operator with the capability to specify destinations with which formatted message communications are authorized.

b. At 5 minutes prior to the start time of each event, the NCCDS shall verify that messages can be exchanged with any external destination that will receive UPD messages for the event. Refer to paragraph 5.8.

    1. For destinations for which external communications are via Nascom 4800 bits/block message, the NCCDS shall use communications test messages to perform this verification.

    2. For destinations for which external communications are via TCP/IP protocol, the NCCDS shall verify that the necessary connections have been established.

    3. The NCCDS shall provide the operator with the capability to enable/disable this function for any selected external destination or address.

9.4.2.2 Nascom 4800 Bits/Block Message Handling Requirements

For those external interfaces through which the NCCDS exchanges Nascom 4800 bits/block messages, the following specific requirements apply:

a. Acknowledgments.

   1. As specified in the applicable interface control documentation, the NCCDS shall determine whether incoming messages have been received correctly or received in error.

   2. For correctly received messages that indicate that acknowledgment is requested, the NCCDS shall transmit an acknowledgment within 2 seconds of receipt.

   3. Messages received in error shall not be acknowledged.

   4. The NCCDS shall check each correctly received message to determine if it is a retransmitted message. If so, the NCCDS shall determine if a previous transmission of the same message has been correctly received. If so, the retransmitted message will be acknowledged but shall not be otherwise processed.

b. Message block metering. The NCCDS shall be capable of metering the transmission of high-speed message blocks so that the transmission rate to any destination does not exceed the maximum rate specified for that destination. The maximum transmission rate for each destination will be specified in terms of a minimum time interval between the initiation of the transmission of two successive high-speed message blocks to that destination. For all messages except stand-alone acknowledgments, the NCCDS message block transmission algorithm shall use these specified minimum time intervals to control the initiation of message block transmissions to each destination. Stand-alone acknowledgment messages may be transmitted as soon as generated.

c. Retransmission.

   1. As specified by the applicable interface control documentation, the NCCDS shall be capable of formatting outgoing messages to indicate that acknowledgment is requested.

   2. For messages for which acknowledgment is requested, if acknowledgment is not received within 5 seconds of transmission the NCCDS shall retransmit the message. The message shall indicate that it is a retransmission.

   3. If acknowledgment of the first retransmission of message is not received within 5 seconds of retransmission, the NCCDS shall retransmit the message a second time.

   4. If acknowledgment of the second retransmission of a message is not received within 5 seconds of retransmission, the NCCDS shall send action alerts to the operator responsible for the nonacknowledged message.

9.4.2.3 Nascom 4800 Bits/Block Communications Performance Indicators

For those external interfaces with which the NCCDS exchanges Nascom 4800 bits/block message, the following specific requirements apply:

a. The NCCDS shall be capable of testing and monitoring the status of electronic message lines, as necessary.

b. The NCCDS shall transmit a communications test message with acknowledgment requested on each circuit-switched line whenever a specified interval of time passes without an acknowledgment being received on that line. Upon failure to receive acknowledgment for an automatically transmitted communications test message on a circuit-switched line, the NCCDS shall inhibit all automatic transmissions on that line until testing indicates the line is up.

c. The NCCDS shall provide the operator with the capability to manually initiate transmission of communications test messages to any selected external destination. [Refer to Note 9.4.2.3-1, 2.]

NOTE 9.4.2.3 – 1

If the operator attempts to initiate a communications test message transmission to an external destination that uses TCP/IP protocol, the NCCDS will verify that a connection has been established but will not transmit an external message.

NOTE 9.4.2.3 – 2

Legacy software (i.e., the CCS) precludes transmission of manually initiated communications test messages to some destinations.

d. Following system startup, restart, and after every relevant reconfiguration, the NCCDS shall complete a successful communications test/acknowledgment sequence with each affected destination prior to beginning exchange of other high-speed messages with that destination.

e. The NCCDS shall provide the operator with the capability to specify the intervals used to control communications control messages (refer to c above).

9.4.2.4 TCP/IP Message Handling Requirements

For those external interfaces using TCP/IP, the NCCDS shall use standard TCP/IP features to assure reliable and timely exchange of messages. Selection of specific TCP/IP options will be specified in lower-level design and interface documents. No specific TCP/IP message exchange requirements are specified herein.

9.4.2.5 TCP/IP Communications Performance Indicators

For those external interfaces using TCP/IP, the NCCDS shall use standard TCP/IP features to assure the availability of each external communications path. [Refer to Note 9.4.2.5-1.] Selection

of specific TCP/IP options will be specified in lower-level design and interface documents. If a communication test message is received on an external TCP/IP connection, the NCCDS shall echo the communication test message back to its source. No other specific TCP/IP message exchange requirements are specified herein.

NOTE 9.4.2.5 – 1

When a complete communications path includes an external TCP/IP connection and an internal 4800 bits/block communications segment, the NCCDS will automatically use communications test messages on the internal segment in conjunction with standard TCP/IP features on the external TCP/IP connection.

9.4.2.6 FTP Message Handling Requirements

For those external interfaces using FTP, the NCCDS shall use standard FTP features to ensure reliable and timely receipt of messages. Selection of specific FTP options will be specified in lower-level design and interface documents. No specific FTP message receipt requirements are specified herein. [Refer to NOTE 9.4.2.6-1]

NOTE 9.4.2.6 – 1

In the NCCDS, FTP is used only to receive IIRV messages. In general, files received via FTP would not be regarded as formatted messages.

9.5 NCCDS Control

9.5.1 General

9.5.1.1 Definitions

The term NCCDS refers to the collection of computer software and hardware devices designed and configured to perform the NCCDS functions specified herein. NCCDS control comprises the following three areas:

- System management.
- Database management.
- Access control.

9.5.1.2 Physical Access to System Management Functions

To the maximum feasible extent, the NCCDS shall provide the operator with the capability to perform all system management functions from a single physical point (e.g., workstation). The workstation provided for the system management functions may omit any of the operator/system interface features specified in paragraph 9.3 that are not relevant to the system management functions.

9.5.1.3 Physical Access to Database Management Functions

To the maximum feasible extent, the NCCDS shall provide the operator with the capability to perform database management functions from a single physical point (e.g., workstation). The workstation provided for the database management functions may omit any of the operator/system interface features specified in paragraph 9.3 that are not relevant to the database management functions.

9.5.2 System Management

9.5.2.1 System Startup

a. The NCCDS shall provide the operator with the capability to specify the NCCDS system configuration that is to be effective as of system startup. This capability may be provided either via interactive selections or via selection from a predefined collection of standard configurations. Specification of the NCCDS system configuration includes:

   1. Specification of which member of a physical pair of devices is to be prime and which is to be backup.

   2. Specification of version numbers for various software components.

   3. Specification of the connections of the processors to the internal local area network.

b. The NCCDS shall provide the operator with the capability to start the system in the configuration specified above.

9.5.2.2 Reconfiguration

The NCCDS shall provide the operator with the capability to modify and verify the current operational NCCDS system configuration via an interactive display.

9.5.2.3 Error Detection

The NCCDS shall include provisions for the automatic detection of errors in processing, memory utilization, input/output processing, and communication. The NCCDS shall log these errors, and shall provide the operator with the capability to view this information.

9.5.2.4 System Recovery

a. The NCCDS shall be capable of automatically reconfiguring itself to recover from system faults/failures. The NCCDS shall send an alert to the operator whenever a reconfiguration is performed. [Refer to Note 9.5.2.4-1.]

NOTE 9.5.2.4 – 1

Legacy elements of the NCCDS (e.g., CCS) may not be able to fully comply with this requirement.

b. The NCCDS shall send an alert to the operator in the event automatic recovery is not possible.

c. The NCCDS shall provide the operator with the capability to inhibit and enable the automatic reconfiguration function. [Refer to Note 9.5.2.4-2.]

NOTE 9.5.2.4 – 2

This capability applies only to the system's automatic response to future faults/failures. It is not intended to allow the operator to initiate an automatic recovery nor to terminate an ongoing automatic recovery.

d. Regardless of whether manual intervention is necessary, the time to perform system recovery shall not exceed 5 minutes.

9.5.2.5 System Status and Monitoring

a. The NCCDS shall monitor the status and internal resource usage of the major hardware and software components.

b. The NCCDS shall record and maintain information pertaining to the status and state changes of NCCDS hardware components. The NCCDS shall provide the operator with the capability to view this information, and to briefly annotate the state change information. All of this information is to be available for use in generating various reports specified in Section 8.

c. The NCCDS shall maintain system loading information, and shall provide the operator with the capability to view this information.

d. NCCDS monitoring shall be accomplished so as not to degrade the performance requirements specified in this document.

9.5.3 Database Management

9.5.3.1 General

The NCCDS database includes all stored dynamic and static data required to perform the functions specified herein. Part or all of the NCCDS database may be under the management of a database management system (DBMS). The following database management requirements apply to all of the NCCDS database regardless of whether it is under control of a DBMS.

9.5.3.2 Data Storage and Manipulation

The NCCDS shall provide for the following:

a. Protection of the database against unauthorized access.

b. A single point of authority for the execution of security requirements and procedures for accessing, updating, creating, and purging files.

c. On-line data entry and verification, controlled from a single point, to ensure centralized control of the construction of files used by the functional elements of the NCCDS and to ensure consistency between the contents of these files and the master files in the database.

d. Retrieval of data by multiple NCCDS operators simultaneously.

e. Allowance of simultaneous update operations to be performed within the performance requirements specified in this document.

9.5.3.3 Data Integrity

The NCCDS shall protect stored data from contamination or loss through misuse or accident by:

a. Enforcing restrictions on authorization to access and/or update files through exclusive or shared control of files.

b. Providing for complete database recovery in the event of malfunction. Regardless of whether manual intervention is necessary, the time to perform database recovery shall not exceed 10 minutes.

c. Allowing for temporary changes to data prior to committing permanent changes.

d. Providing a record of permanent changes following data entry and verification.

9.5.4 Access Control

9.5.4.1 System Access

Operator access to the NCCDS shall be restricted. Access restriction shall be based on records of authorized operators and passwords. Also refer to Section 10.

9.5.4.2 Database Access

[Refer to Note 9.5.4.2-1.] The NCCDS shall protect against:

a. Unauthorized access to the database management functions.

b. Unauthorized entry of data into or modification of data in the database. This includes instances in which data is originally created off-line and is then copied into the NCCDS database. It also includes any modification of the database via remote access.

c. Unauthorized retrieval of data from the database via remote access. [Refer to Note 9.5.4.2-2.]

NOTE 9.5.4.2 – 1

Refer to Section 10 for related security requirements.

NOTE 9.5.4.2 – 2

There are no specific requirements for remote database access. Hence, these requirements can be satisfied by denying all remote database access.

9.5.4.3 Access Authority and Password Control

The NCCDS will allow for modification of records of authorized operators and passwords as follows:

a. The NCCDS shall provide the most privileged operator with the exclusive capability to modify records of authorized operators and passwords for the following purposes:

   1. Granting of access authorization to new operators.

   2. Manual or automatic assignment of initial passwords to new operators.

   3. Refreshment of expired passwords.

   4. Termination of access authorization.

b. The NCCDS shall automatically cease to accept expired passwords, and shall provide the most privileged operator with the capability to specify the expiration interval.

c. The NCCDS shall provide each authorized operator with the capability to change his or her own password at any time prior to its expiration.

d. The NCCDS shall also provide the most privileged operator with the capability to change any authorized operator's password at any time.

9.6 NCC Testing

9.6.1 General

The NCC shall be capable of supporting the following activities, on a noninterference basis, with the operational capabilities of the NCCDS:

a. System development.

b. System testing.

c. Operator training and evaluation.

d. Customer interface testing.

9.6.2 System Development

The NCC shall have the capacity to support development and enhancement.

9.6.3 System Testing

The NCC shall be capable of creating test message sequences. The NCCDS shall respond to the test message sequences as if they had originated externally. The NCC shall be capable of processing and analyzing these responses. This capacity will be used for the testing and validation of all NCCDS modifications.

9.6.4 Operator Training and Evaluation

The NCC shall be capable of generating sequences of console displays and alerts for the purpose of training operators and evaluating operator performance. The NCC shall be capable of exercising, measuring, and evaluating all operator actions and responses.

9.6.5 Customer Interface Testing

The NCC shall be capable of receiving, validating, and responding to customer test messages for the purpose of validating the customer interface with the NCCDS. The NCC shall not transmit any messages to another SN element in response to customer test messages. In addition, the NCC shall be capable of informing customers of the specific reasons for any test messages failing security validation.

9.7 NCCDS Workload Capacity

9.7.1 General

The following paragraphs define the NCCDS capacity requirements in terms of required workload. The workload is defined for the 1998-2001 timeframe. This workload embodies several significant worst-case assumptions and is therefore not intended to provide, and should not be interpreted as providing, complete and consistent predictions of the actual operational profile of the NCCDS during the indicated time. This workload definition is intended to be used as the basis for the creation of benchmarks that will be used to verify the capacity of the NCCDS. In any instance where an explicit requirement is provided elsewhere in this document that is more stringent than the requirements provided by or implied by the following paragraphs, the more stringent requirement has precedence.

9.7.2 Workload for 1998-2001

The NCCDS shall be capable of meeting all functional, performance, and reliability/maintainability/availability (RMA) requirements associated with the capabilities planned for operational availability during 1998-2001 when burdened with the workload defined in the following paragraphs. During the time period allowed (refer to paragraph 5.9.4.2) for the execution of a batch scheduling run which occurs concurrently with the reception and transmission of schedule requests, schedules, acquisition data and performance data at the specified capacities, utilization of NCCDS input/output (I/O) and central processing unit (CPU) capacities shall not exceed an average of 30 percent.

9.7.3 Scheduling

The NCCDS is to be capable of performing schedule generation, schedule maintenance, schedule dissemination, and all other processing associated with the support of 400 events per day. This activity is characterized as follows:

a. Of the 400 supported events, 50 percent are rescheduled during active schedule maintenance. Rescheduling includes customer-initiated rescheduling, rescheduling in response to revised TSWs, and rescheduling in response to equipment status changes.

b. There is an 8-hour period each day during which most of the requests for rescheduling are submitted. The NCCDS is to be capable of receiving, processing, and transmitting 200 schedule updates during this 8-hour period each day.

c. The 400 events are randomly distributed throughout the 24-hour period, with the greatest number of concurrent events being 36.

d. The average event duration is 25 minutes.

e. Prior to operator intervention, 70 percent of submitted SARs result in an event being scheduled. Operator intervention results in a total of 96 percent of submitted SARs result in an event being scheduled.

f. Schedule generation is performed for 7-day intervals.

g. There is one 8-hour period during each week during which most of the schedule requests for the week are submitted. The NCCDS is to be capable of receiving 3000 requests during this 8-hour period.

h. WSGT receives schedules for 50 percent of events. STGT receives schedules for the other 50 percent of events. The NEST receives schedules for all events. SDPF receives schedules for 10 percent of events.

9.7.4 Schedule Retransmission

In addition to the schedule dissemination workload implied by paragraph 9.7.3, the NCCDS is to be capable of retransmitting 25 percent of the number of schedule messages originally transmitted to each destination.

9.7.5 TSWs

The NCCDS is to be capable of receiving, validating, and storing 2000 original TSWs and 1000 revised TSWs per day.

9.7.6 User Reconfigurations

The NCCDS is to be capable of supporting five User Reconfiguration Request GCMRs per event.

9.7.7 Acquisition Data

a. The NCCDS is to be capable of sustaining reception of IIRV messages at a rate of 4 messages per second.

b. The NCCDS is to be capable of sustaining transmission of IIRV messages to either the WSGT or the STGT at a rate of 4 messages per second.

9.7.8 Performance Data

a. The NCCDS is to be capable of sustaining reception and monitoring of ODMs from the WSGT and the STGT at the capacity of the TDRSS:

   1. One SA/SMAR ODM once per 5 seconds for each of six TDRSs.

   2. One MA/SMAF ODM once per 5 seconds for each of six TDRSs.

   3. One end-to-end test ODM once per 5 seconds for each of six TDRSs.

b. The NCCDS is to be capable of sustaining generation and transmission of User Performance Data Messages to each of 36 customers at a rate of 1 message per 5 seconds.

9.7.9 NCC Console Operator Display Updates

The NCCDS is to be capable of sustaining a display update rate of one display per workstation per second.

9.7.10 Miscellaneous

The preceding paragraphs have provided workload definitions for functions that individually impose significant demands on the system. There are numerous other functions that do not individually impose significant workloads on the system, but that do so collectively. The NCCDS shall provide an additional processing capacity for these miscellaneous functions that is at least 30 percent of the capacity needed to meet the workload defined by paragraphs 9.8.3 through 9.8.9 (i.e., the total processing capacity should be at least 130 percent of that needed for the workload defined in paragraphs 9.8.3 thorough 9.8.9). These miscellaneous functions include all functions specified elsewhere in this document and not explicitly mentioned in paragraphs 9.8.3 through 9.8.9. The miscellaneous functions include, but are not limited to the following:

- Spacecraft database maintenance and review.
- Wait list processing.
- Delta-T messages.
- TDRSS-unique reconfigurations.
- Administrative messages.
- SLRs.

- Service accounting.
- Message logging.
- Creation of database audit files and dump tapes.
- Unspecified batch jobs.

9.8 Response Time Requirements

9.8.1 Nominal Response Time Values

In all cases, the response time values given throughout this document are nominal, rather than absolute, times. For all system responses, other than high-speed message acknowledgment, the NCCDS shall generate 95 percent of responses within the nominal time, 99 percent of responses within 150 percent of the nominal time, and 100 percent of responses within 200 percent of the nominal time. For high-speed message acknowledgment, the NCCDS shall generate 99 percent of acknowledgments within the nominal time, and 100 percent of acknowledgments within 150 percent of the nominal time.

9.8.2 Common Response Times

Except where some other value is explicitly specified, the nominal response time value for the following three categories of system responses is 5 seconds:

a. The time from the receipt of a formatted message until a required system response occurs.

b. The time from the receipt of an operator entry or request until the required system response occurs.

c. The time from the occurrence of some event until the presentation of the required alert.

9.8.3 Queuing of Formatted Messages and Alerts

Backlogs of formatted messages for transmission to a particular destination and backlogs of alerts for presentation to a particular NCC console operator can occur that are beyond the control of the NCCDS. When such backlogs exist, it is sufficient for the NCCDS to queue the required messages or alerts within the specified time.

Section 10. Security

10.1 General

10.1.1 Sensitivity/Criticality Level

The *NASA Automated Information Security Handbook*, NHB 2410.9A, defines four automated information sensitivity/criticality (SC) levels. Of these four levels, SC 3 is the most sensitive. In part, SC 3 implies that inaccuracy, alteration, disclosure or unavailability of such information could permanently violate the integrity of NASA's missions. Some of the information handled by the NCCDS has been determined to be SC 3 information. However, none of this information is classified.

10.1.2 Security Mode

It has been determined that it would be neither feasible nor beneficial to require the NCCDS to separate SC 3 information from other information at lower SC levels. Hence, the NCCDS operates in system high mode with all information handled as if it were SC 3 information.

10.1.3 Security Requirements

The NCCDS must meet the security requirements applicable to a system high sensitive unclassified domain at the SC 3 level.

10.1.4 Requirements Derivation

The requirements in this section are derived from the SC 3 requirements specified in NHB 2410.9A, as interpreted for the functional environment of the NCCDS. Most of the following requirements are direct paraphrases from NHB 2410.9A. However, the requirements dealing with external interface security extend the SC 3 DBMS security requirements to the external data consumer/provider interface, since that is the ultimate destination/source of the data. It is assumed that all functional interactions with external systems will be through explicitly defined mechanisms and that interactive external access is limited to retrieval of information that is not customer-specific, except for SN elements which may retrieve the entire SN schedule or any part of it.

10.1.5 NCCDS Perimeter

All requirements in this section presume that the NCCDS system perimeter is also a well-defined SC 3 security perimeter. Therefore any NCC subsystems that only handle data at a sensitivity/criticality level below SC 3 must be considered to be "external" with respect to these SC 3 security requirements. Any interface between the NCCDS and any such NCC subsystem must comply with the requirements for NCCDS external interfaces.

10.1.6 Precedence

With regard to security, the requirements specified in this section take precedence over any other requirements stated or implied in any other section of this document.

10.1.7 Terminology

This section uses the term "operator" to refer to any individual within the NCC facility who may access the NCCDS. In no case, does "operator" refer to an individual or system external to the NCC facility.

10.2 Operator Access Control

The following operator access control requirements apply to the NCCDS:

a. At all times, the NCCDS shall restrict individual operator access to system resources and data.

b. The NCCDS shall provide the capability for administrative restriction of the functional capabilities of individual operators.

c. The NCCDS shall provide each operator with the capability to manage access by other operators to any information or applications that are unique to that operator. [Refer to Note 10.2-1.]

NOTE 10.2 – 1

Within the NCCDS, the majority of information will not be unique to any individual operator. It is not necessary to implement this capability for operators that will never have individually unique information.

10.3 Operator Identification and Authentication

The following operator identification and authentication requirements apply to the NCCDS:

a. The NCCDS design shall restrict operator access to terminals and workstations physically connected to SC 3 networks or ports within the perimeter of the NCC Data Processing Installation (DPI) management control.

b. The NCCDS shall apply identification and authentication of individual operators to prevent access by unauthorized persons.

10.4 System Entry

The NCCDS shall provide for automated logout of operators who have been inactive for an administratively selectable time period. [Refer to Note 10.4-1.]

NOTE 10.4 – 1

The NCCDS meets the general intent of this requirement by requiring operators who have been inactive for an operator-specified time-out period to re-enter their passwords prior to any further activity. However, the operator is not logged out and processes initiated by the operator continue to run.

10.5 Initial Operator Communications Path

The NCCDS shall provide a well-defined path between the system and operator to protect the initial operator identification and authentication process against operator or system masquerade.

10.6 Operator Audit

The following operator audit requirements apply to the NCCDS:

a. The NCCDS shall provide measures that can at all times log individual operator access by system resource, application, and information files.

b. The NCCDS shall provide the capability for the generation of audit logs of operator accesses to the system and to information and applications.

c. The NCCDS shall provide the capability to audit accesses at the individual operator level.

d. The NCCDS shall be capable of restricting access to audit logs to a well-defined subgroup of operators selectable by DPI management.

10.7 Assurance and Documentation

The following assurance and documentation requirements apply to the NCCDS:

a. All NCCDS software shall be tested to assure the proper functionality of all security features including a review of Audit trail and log reports on both successful and failed operations.

b. Any change to any security-related and sensitive software, hardware, or procedure for the NCCDS shall be monitored via a configuration management process.

c. All communications paths for the NCCDS shall be documented and maintained.

10.8 Database Management System Security

The following database management system security requirements apply to the NCCDS:

a. The NCCDS shall maintain the integrity of information in its databases.

b. The NCCDS shall maintain the confidentiality of information in its databases.

c. The NCCDS design shall ensure the availability of its databases.

10.9 External Information Exchange Security

The following external information exchange security requirements apply to the NCCDS:

a. The NCCDS shall provide for the generation of an audit trail of information entering or exiting the system.

b. The NCCDS shall provide the capability to selectively record information exchange entry/exit attempts on the basis of success/failure, information source, information destination, and type of information.

c. The NCCDS is to provide an external low-level communications audit capability.

   1. The NCCDS shall have the capability to selectively record the passage or attempted passage into or out of NCCDS of low-level datagram or message block protocol data units (PDUs).

   2. The NCCDS shall provide the operator with the capability to specify the criteria for selective recording of PDUs in terms of any combination of:

      (a) Protocol carried end-points.

      (b) Protocol carried protocol parameters.

      (c) PDU disposition.

   3. Within each PDU event record, the NCCDS shall include:

      (a) Event time.

      (b) Nominal communication end-points and protocol parameters.

      (c) PDU disposition.

   4. The NCCDS shall provide the capability for an authorized operator to selectively retrieve recorded PDU event records based on time, the protocol end-points and protocol parameters, and the PDU disposition.

d. The NCCDS is to provide a primary external message audit capability.

   1. The NCCDS shall have the capability to selectively record the passage or attempted passage into or out of the NCCDS of primary, application-level messages.

   2. The NCCDS shall provide the operator with the capability to specify the criteria for selective recording of NCCDS messages in terms of any combination of:

      (a) Logical remote end-point.

      (b) Message type and class.

      (c) Disposition.

3. The NCCDS shall record application-level messages in plaintext form (i.e., after decryption of encrypted incoming messages and before encryption of encrypted outgoing messages).
4. Within each recorded application-level message record, the NCCDS shall include:
   (a) Event time.
   (b) Nominal communication end-points and protocol parameters.
   (c) The message, itself.
   (d) Message disposition.
5. The NCCDS shall provide the capability for an authorized operator to selectively retrieve recorded message records based on time, the nominal communication end-points and protocol parameters, and disposition.

e. For messages that should arrive only via dedicated interfaces (e.g., STGT and WSGT), the NCCDS shall compare source IP addresses with message content to ensure that such messages do not arrive via other interfaces.

Section 11. Reliability/Maintainability/Availability

11.1 Introduction

Due to the NCC's role in the SN, the NCCDS must provide support to the SN customers in a highly reliable manner. This section specifies RMA requirements for two categories of functions, presents a hardware maintenance concept, and specifies criteria for the validation of the RMA requirements.

11.2 Categories of Functions

11.2.1 General

The functions of the NCCDS are diverse. Some of the functions are critical to the ongoing support provided to SN customers. Others are concerned with SN activities either many days in the future or many days in the past. Such diversity of functions precludes a single level of RMA requirements for the NCCDS. For the purpose of defining appropriate RMA requirements, the functions of the NCCDS are partitioned into two categories.

11.2.2 Critical Support Functions

Critical support functions are those functions of the NCCDS that are concerned with providing active support to SN customers, that have no feasible procedural backup, and whose failure would either have immediate impact to SN customers, or could result in nonrecoverable loss of data. Critical support functions are as follows:

a. GCMR processing, as specified in paragraphs 6.4.2 and 6.4.3, and in applicable portions of paragraph 6.4.5.

b. Performance data dissemination as specified in paragraphs 6.4.6, 6.5, and 7.3.

c. The portions of the external communications interface necessary to support the above functions, as specified in paragraph 9.4.

d. The portions of the operator/system interface necessary to support the above functions, as specified in paragraph 9.3.

e. All portions of system operation as specified in Section 9 necessary to support the above functions and not previously listed.

f. For all of the above functions, the applicable portions of service accounting data accumulation as specified in paragraph 8.2.2.

11.2.3 Noncritical Functions

All functions of the NCCDS not identified in paragraph 11.2.1 as providing critical support to SN customers are termed noncritical. All noncritical functions either have feasible procedural backup or can fail without immediate impact to the SN customers.

11.3 Failure Definitions

11.3.1 General

a. For each of the preceding categories of functions, an interruption interval is a period of time during which use of at least one of the functions within that category is interrupted. When use of a function involves interaction via an NCC console, the function is regarded as interrupted only when the NCCDS is unable to support the interaction at an operationally sufficient number of NCC consoles, not when the NCCDS is unable to support the interaction at a particular console.

b. A system failure occurs when either the number of or the accumulated durations of the interruption intervals occurring within a specified time reach specified maximums.

11.3.2 Definition of Interruption Interval

An interruption interval is a period of time meeting any of the following criteria:

a. For functions whose outputs are not direct responses to inputs, the expected outputs are missing during the period.

b. For functions whose outputs are direct responses to inputs, inputs received during the period do not result in the expected outputs.

c. For functions whose outputs are direct responses to inputs, specified maximum response times are not met. [Refer to Notes 11.3.2-1, 2, 3.]

NOTE 11.3.2 – 1

These definitions of interruption interval presume that under normal circumstances all relevant functional and performance requirements are met.

NOTE 11.3.2 – 2

In other words, an interruption is always a deviation from the normal behavior of the system rather than a permanent inability to meet a particular functional or performance requirement.

NOTE 11.3.2 – 3

More formally, it is presumed that RMA verification would be performed only after it is established that the system meets its functional and performance requirements.

11.3.3 Definition of Failure

A failure is either:

a. A specified number of interruption intervals since the most recent failure, or in the previous 168 hours if the most recent failure occurred more than 168 hours ago. These numbers are: three for critical support functions, and four for noncritical support functions.

b. A specified accumulation of interruption interval durations since the most recent failure, or in the previous 168 hours if the most recent failure occurred more than 168 hours ago. These accumulated durations are: 5 minutes for critical support functions, and 20 minutes for noncritical support functions.

11.4 System Reliability

Based on the definitions provided by paragraphs 11.2 and 11.3, the NCCDS shall have a mean time between failures (MTBF) of at least:

a. 2500 hours for critical support functions.

b. 1000 hours for noncritical support functions. [Refer to Note 11.4-1.]

NOTE 11.4 – 1

Due to the lack of a fully automated failover capability in its legacy elements, the NCCDS does not fully meet these MTBF requirements.

11.5 System Maintainability

The maintainability requirement for the NCCDS is stated in terms of the mean time to repair (MTTR) parameters for each of the preceding categories of functions. For each of these categories of functions, MTTR is the quotient obtained by dividing the sum of the times to repair failures of functions within the category by the number of failures. The time to repair a failure is the sum of the durations of the interruption intervals culminating in the failure and the elapsed time from the occurrence of the failure to the time at which the failed functions are again available for operational use. Excluded from time to repair are the time to obtain parts, components, tools or supplies not provisioned at the NCC facility, the time for essential personnel not scheduled to be at the NCC facility to be notified of the failure and to travel to the NCC facility, and the time to develop and configure software corrections. Based on the preceding definitions, the NCCDS shall have an MTTR no greater than:

a. 30 minutes for critical support functions.

b. 60 minutes for noncritical support functions.

11.6 Hardware Maintenance Concept

11.6.1 On-Line Diagnostics

To achieve the mission requirements, the NCCDS shall be designed with a complete on-line diagnostic capability that allows isolation of malfunctions to the line replaceable unit (LRU) level. Every component of the NCCDS shall have an on-line diagnostic capability. In the event of an internal malfunction that does not constitute a system failure, the on-line diagnostic capability of the NCCDS shall function while the NCC is simultaneously performing its operational mission. The NCCDS shall provide the operator with the capability to operate these diagnostics. [Refer to Notes 11.6.1-1, 2, 3.]

NOTE 11.6.1 – 1

Some of the diagnostics for legacy elements of the NCCDS may be restricted to off-line operation.

NOTE 11.6.1 – 2

Some of the diagnostics for legacy elements of the NCCDS may be restricted to operation from computer consoles.

NOTE 11.6.1 – 3

Some of the diagnostics for legacy elements of the NCCDS may be restricted to the specific operators.

11.6.2 Overall Maintenance Concept

The maintainability requirement is predicated on the implementation and effective utilization of an overall maintenance concept for the NCC. The NCC maintenance concept provides for repair and replacement of LRUs at the organizational level. All repairs beyond the organizational level of maintenance are examined and repaired, if possible at the intermediate level. Repairs beyond the intermediate-level capability will be accomplished at the depot level by a designated repair depot, vendor, or the Module Repair Facility. Equipment covered under a warranty program will be returned to the appropriate vendor for repair. Preventive and corrective maintenance are an integral part of all maintenance levels.

a. Corrective maintenance performed for the NCC at the organizational level will be based on LRU removal and replacement. Maintenance personnel will be trained to isolate equipment malfunctions without interruption of ongoing operations.

b. The hardware of the NCCDS shall be designed to permit easy access to, and replacement of, LRUs. The hardware design of the NCCDS shall permit failed units to be removed from the equipment and replaced without cutting, unsoldering, unwrapping, or otherwise requiring more disassembly than removing retaining screws and connectors.

c. Faulty units beyond the repair capability of NCC maintenance personnel will be repaired at an off-site maintenance facility where necessary jigs, fixtures, technical manuals, and test equipment are to be available. Repaired units will be returned to stock

to replace units consumed to maintain equipment operation. Each NCCDS hardware item shall be furnished with all applicable special tools (e.g., cable extenders, cable extractors, and circuit card extenders required for maintenance), other necessary special purpose contractor-supplied equipment, and technical manuals.

11.6.3 Internal Failures

In the event of an internal failure that does not constitute a system failure, the design of the NCCDS shall permit detection and isolation of an equipment failure to the LRU level to be carried out by a combination of self-test and diagnostic software, equipment test features, built-in test equipment (BITE), technical manuals, and special test equipment. The NCCDS self-test and diagnostic software shall operate under the control of and in conjunction with the NCCDS operational software. The NCCDS hardware devices shall be supplied with BITE, or have BITE incorporated into them. [Refer to Note 11.6.3-1.] The necessary technical documentation is to be supplied or prepared to support corrective maintenance activities of the maintenance personnel within the NCC. The NCCDS shall be designed and configured so that corrective maintenance can be performed with minimal use of special test equipment in order to keep the area within the NCC open for operational personnel.

NOTE 11.6.3 – 1

Some of the legacy NCCDS hardware devices may not have BITE.

11.6.4 Repair Facilities

The actual repair of a failed component in a removed LRU is to be carried out at either an intermediate repair facility or a depot repair facility. An intermediate repair facility is one within the immediate vicinity of the NCC on or near GSFC. A depot repair facility is considered to be either a contractor-operated maintenance facility or a vendor facility. The times associated with repair activities at both the intermediate and depot repair levels are not included in the system MTTR time values.

11.6.5 Repairs

The repair of failed components for other than system failures is to be carried out in the most expeditious manner through either LRU replacement or repair of the component within the NCC. Repair activity is only to be conducted in a manner that does not impact ongoing NCC operations.

11.6.6 Preventive Maintenance

PM is to be performed on equipment within the NCC as recommended by the supplier or vendor of equipment. The NCCDS shall be designed and configured so that required PM can be performed without the routine scheduling of downtime. PM for any device is to be carried out on the basis of noninterference with NCC operations and primarily during periods of reduced activity.

11.6.7 Logistics Program

Effective maintenance, both corrective and preventive, of the NCC for continuous operation necessitates the establishment of a supporting logistics program. The supply support stock levels of this program for all consumables, spare parts, and devices is to be developed in accordance with the procedures given in the *GSFC Specification*, GSFC-S-530-1, *Spare Parts Program*.

11.7 System Availability

Availability is defined as the quotient of MTBF divided by the sum of MTBF and MTTR. Since MTBF and MTTR requirements have been defined, the availability requirements are as follows:

a. The NCCDS shall provide an availability of 0.9998 for the critical support functions.

b. The NCCDS shall provide an availability of 0.9990 for the noncritical functions. [Refer to Note 11.7-1.]

NOTE 11.7 – 1

Due to the lack of a fully automated failover capability in its legacy elements, the NCCDS does not fully meet these availability requirements.

11.8 Validation

Each RMA requirement for the NCCDS shall be validated statistically with an 80-percent confidence factor. RMA modeling techniques may be used to demonstrate compliance with the RMA requirements. Such modeling techniques shall only be applied when actual failure and repair data exists to support such analysis.

Section 12. Message List

The following descriptions include a source/destination associated with the message followed (in parentheses) by the applicable reference when one exists.

Type	*Class*	*Name*	*Description*
n.a.*	n.a.	Acknowledgment	Acknowledges receipt of a message. (NCCDS/many, many/NCCDS)
		*not applicable	
02		**Scheduling Order Data Message-SHO**	
	01	Normal	Describes services contained in a normal SHO. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	03	End-to-End Test	Describes services contained in an end-to-end test SHO. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	06	Inter-Facility Link (IFL)	Describes services contained in IFL SHO. (NCCDS/WSGT) WSC ICD
03		**Operations Message-OPM**	
	01	Special Instructions or Requests	Used to send free-form alphanumeric text messages. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	02	Reacquisition Request	Used to initiate a reacquisition. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	03	Reconfiguration Request	Used to reconfigure equipment supporting a customer spacecraft. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	04	Forward Link Sweep Request	Used to initiate a sweep of the forward-link carrier frequency. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	06	Forward Link EIRP Reconfiguration Request	Used to set the SSA or KuSA/KaSA EIRP to normal or high power. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	07	Expanded User Frequency Uncertainty Request	Used to increase receiver bandwidth for DG1, mode 2 and DG2 (noncoherent). (NCCDS/WSGT, NCCDS/STGT) WSC ICD

Type	*Class*	*Name*	*Description*
03		**Operations Message-OPM (continued)**	
	09	Test	Used to verify that the communication links between the NCCDS and the STGT or WSGT is functioning. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	10	Improved Interrange Vector (IIRV) Nominal	Used to transmit position and velocity data. (FDF/NCCDS, NCCDS/WSGT, NCCDS/STGT, customers/NCCDS) NCCDS/FDF-ICD, WSC ICD
	11	Doppler Compensation Inhibit Request	Terminates forward-link Doppler compensation. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	12	Cancel SHO Request	Used to request cancellation of either ongoing or pending SHO. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	13	TDRS Maneuver Approval	Used to approve or deny a TDRSS maneuver request. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	14	Acknowledgment of Message Received	Acknowledges receipt of a message. (NCCDS/FDF, NCCDS/Nascom, NCCDS/WSGT, NCCDS/STGT, NCCDS/Customer) NCCDS/FDF-ICD, NCCDS/Nascom-CSS ICD, WSC ICD, NCCDS/MOC ICD
	15	Improved Interrange Vector (IIRV) Inflight Update	Used to transmit position and velocity data. (FDF/NCCDS, NCCDS/WSGT, NCCDS/STGT) NCCDS/FDF-ICD, WSC ICD
	18	Delta-t Adjustment	Used to adjust the epoch time parameter within state vectors. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	51	SHO Status	Used to inform NCC of the status of a SHO. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	52	Return Channel Time Delay Data	Used to send return-channel time delay data to NCC. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	53	Preventive Maintenance (PM) Request	Used to request TDRSS preventive maintenance. (WSGT/NCCDS, STGT/NCCDS) WSC ICD

Type	*Class*	*Name*	*Description*
	54	Special Requests or Information	Used to send free-form alphanumeric text from TDRSS. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
03		**Operations Message-OPM (continued)**	
	57	Service Terminated	Notification to NCC of the termination of a service. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	59	TDRS Maneuver Request	Used to request approval for a TDRS spacecraft maneuver. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	60	Acknowledgment of Message Received	Used to acknowledge receipt of a message. (FDF/NCCDS, Nascom/NCCDS, WSGT/NCCDS, STGT/NCCDS) NCCDS/FDF-ICD, NCCDS/Nascom-CSS ICD, WSC ICD
	61	State Vector Rejection	Used to reject state vector. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	62	OPM Status	Used to accept or reject OPM. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	63	Acquisition Failure Notification	Provides notification that TDRSS cannot acquire a customer spacecraft. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	64	Real Time Mode	Used to inform NCC when a spacecraft enters or exits real time mode. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	65	Delta-t Adjustment Rejection	Used to inform NCC that a Delta-t adjustment has been rejected. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	66	Time Transfer	Used to send time transfer data to NCC. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
	68	DELETED	
04	n.a.	Service Level Status Report (SLR)	Notifies NCC of changes in equipment status. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
05	n.a.	SA/SMAR Operations Data Messages (ODM)	Used to send operations data to NCC. (WSGT/NCCDS, STGT/NCCDS) WSC ICD

Type	*Class*	*Name*	*Description*
06	n.a.	MA/SMAF Operations Data Messages (ODM)	Used to send operations data to NCC. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
07	n.a.	End-to-End Test Operations Data Messages (ODM)	Used to send operations data to NCC. (WSGT/NCCDS, STGT/NCCDS) WSC ICD
08		**Periodic SHO**	
	01	Normal	Describes services contained in a normal SHO. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	03	End-to-End Test	Describes services contained in an end-to-end test SHO. (NCCDS/WSGT, NCCDS/STGT) WSC ICD
	06	IFL	Describes services in IFL SHO. (NCCDS/WSGT) WSC ICD
90		**Nascom Control and Status System Message**	
	01*	Nascom Event Schedule (NES)	Notifies Nascom of scheduled support. (NCCDS/Nascom) NCCDS/Nascom-CSS ICD
	02*	Nascom Event Cancel (NEC)	Notifies Nascom that a pending or active event is canceled. (NCCDS/Nascom) NCCDS/ Nascom-CSS ICD
	04*	Nascom Event Schedule Update (NESU)	Notifies Nascom of updates to the schedule. (NCCDS/Nascom) NCCDS/ Nascom-CSS ICD
	05*	Nascom Event Schedule Emergency (NESE)	Used to provide premium support scheduling changes or additions. (NCCDS/Nascom) NCCDS/ Nascom-CSS ICD
	06*	Nascom Reconfiguration Request (NRR)	Generated by NCCDS to effect reconfiguration of a Nascom data stream. (NCCDS/ Nascom) NCCDS/ Nascom-CSS ICD
		* Message format is also used within NCCDS/SDPF interface.	
	07	Nascom Reconfiguration Accept/Reject (NRAR)	Reports to NCC acceptance or rejection of a Nascom reconfiguration. (Nascom/NCCDS) NCCDS/Nascom-CSS ICD

Type	*Class*	*Name*	*Description*
91		**User Monitoring Message**	
	01	User Performance Data Message	Used to send operations data to customers. (NCCDS/Customer) NCCDS/MOC ICD
	03	Communications Test Message	Used to verify that the communications link between the NCCDS and an external entity is functioning. (NCCDS/many, many/NCCDS)
92		**Performance Data Message**	
	04	User Performance Data Request	Allows the customer to select or deactivate performance data. (Customer/NCCDS) NCCDS/MOC ICD
	62	Return Channel Time Delay Measurement	Used to transmit STGT and WSGT return-channel time delay measurement data from NCC to customer. (NCCDS/Customer) NCCDS/MOC ICD
	63	Acquisition Failure Notification	Notifies the customer that return services did not occur due to the inability of TDRSS to acquire customer spacecraft. (NCCDS/Customer) NCCDS/MOC ICD
	66	Time Transfer	Used to transmit time transfer data from NCC to customer. (NCCDS/Customer) NCCDS/MOC ICD
94		**User Schedule Message**	
	01	Normal Support -- Fixed Schedule	Describes services contained in a normal support schedule event. (NCCDS/Customer) NCCDS/MOC ICD
	02	Premium Support -- Fixed Schedule	Describes services contained in a premium support schedule event. (NCCDS/Customer) NCCDS/MOC ICD
	03	Simulation Support -- Fixed Schedule	Describes services contained in a simulation support schedule event. (NCCDS/Customer) NCCDS/MOC ICD
	04	Normal Support -- Flexible Schedule	Describes services contained in a normal support schedule event. (NCCDS/Customer) NCCDS/MOC ICD
	05	Simulation Support -- Flexible Schedule	Describes services contained in a simulation support schedule event. (NCCDS/Customer) NCCDS/MOC ICD
98		**Ground Control Message Control**	

Type	*Class*	*Name*	*Description*
	01	GCM Status	Transmitted to the customer either upon receipt of an invalid GCMR or upon receipt of an OPM status from WSGT or STGT. (NCCDS/Customer) NCCDS/MOC ICD
	02	GCM Disposition	Transmitted to the customer to indicate whether or not an acknowledgment was received from WSGT or STGT. (NCCDS/Customer) NCCDS/MOC ICD
	03	User Reacquisition Request	Provides the customer the capability to request a service-compatible link reacquisition procedure. (Customer/NCCDS) NCCDS/MOC ICD
	04	User Reconfiguration Request	Provides the customer the capability to request a reconfiguration of a specified service. (Customer/NCCDS) NCCDS/MOC ICD
	05	Forward Link Sweep Request	Provides the customer the capability to request a forward-link sweep on the designated service. (Customer/NCCDS) NCCDS/MOC ICD
	06	Forward Link EIRP Reconfiguration Request	Provides the customer the capability to request a reconfiguration of the SSA or KuSA/KaSA forward-link EIRP between normal and high power at TDRSS. (Customer/NCCDS) NCCDS/MOC ICD
	07	Expanded User Frequency Uncertainty Request	Provides the customer the capability to expand the frequency uncertainty of the referenced ongoing return service. (Customer/NCCDS) NCCDS/MOC ICD
	08	Doppler Compensation Inhibit Request	Provides the customer the capability to request that forward link Doppler compensation on the specified link be inhibited. (Customer/NCCDS) NCCDS/MOC ICD
99		**Schedule Message**	
	01*	Schedule Deletion Notification	Used to notify customer of the deletion of an event. (NCCDS/Customer) NCCDS/MOC ICD
		* Applicable only for baseline customers making no modifications for SPSR.	
	02	Schedule Result Message	Sent to customer in response to a schedule request. (NCCDS/Customer) NCCDS/MOC ICD

Type	*Class*	*Name*	*Description*
	10	Schedule Add Request	Used by a customer to request addition of an event to the schedule. (Customer/NCCDS) NCCDS/MOC ICD
	11	Schedule Delete Request	Used by a customer to request deletion of an event from the schedule. (Customer/NCCDS) NCCDS/MOC ICD
	12	Schedule Replace Request	Used by a customer to request replacement of an existing event on the schedule. (Customer/NCCDS) NCCDS/MOC ICD
	21	Alternate Schedule Add Request	Used by a customer to specify an alternate to a previously submitted request. (Customer/NCCDS) NCCDS/MOC ICD
	24	Schedule Wait List Request	Used by a customer to request that a declined request be placed on the wait list. (Customer/NCCDS) NCCDS/MOC ICD
	25	TDRS Scheduling Windows	Used by a customer to specify windows during which events may be scheduled on specified TDRSs. (Customer/NCCDS) NCCDS/MOC ICD
	28	Schedule Result Request	Used by a customer to specify routing of User Schedule and Schedule Result Messages. (Customer/NCCDS) NCCDS/MOC ICD
N/A		PTP Command Messages	
	N/A	PTP Event Command	Used to notify PTPs of the addition of a WDISC event. (NCCDS/PTPs) NCCDS/WDISC Interface Agreement
	N/A	PTP Event Response	Used to inform NCC of the status of a PTP Event. (PTPs/NCCDS) NCCDS/WDISC Interface Agreement
	N/A	PTP Delete Command	Used to notify PTPs of the deletion of a WDISC event. (NCCDS/PTPs) NCCDS/WDISC Interface Agreement
	N/A	PTP Delete Response	Used to inform NCC of the status of a PTP Delete. (PTPs/NCCDS) NCCDS/WDISC Interface Agreement

Section 13. TDRSS Unscheduled Time Algorithms

13.1 General

In general, the SN does not disclose the exact details on any customer's schedule to any other customer. TDRSS Unscheduled Time (TUT) algorithms are herein specified that allow all usable unscheduled time blocks to be distributed, but do not associate any of the scheduled time periods with specific customers. Three different algorithms are specified:

- Single Access Antenna.
- Multiple Access Forward Antenna.
- Multiple Access Return Link.

13.2 Flexible Events

The active schedule comprises a mixture of fixed and flexible events. In all cases, the determination of TUT blocks is to be based on the earliest possible stop time of the service immediately prior to the TUT block and the latest possible service start time of the service immediately after the TUT block. If resource flexibility is retained for an event, determination of TUT blocks is to be based on an estimation of the resources that would be used if the event had been frozen at the time of TUT generation. Also refer to paragraph 5.3.4.2.3.

13.3 TUT Algorithm for SA Antennas

For each SA antenna for each TDRS, TUT is to be determined as follows:

a. Based on the start and stop times of all SA services within the active schedule, identify all unscheduled blocks.

b. Add the SA slew time to the beginning of each unscheduled block.

c. Subtract the SA slew time from the end of each unscheduled block.

d. Eliminate any blocks whose resultant duration is now less than one minute (i.e., the minimum valid TDRSS service duration).

e. Eliminate any blocks that are unscheduled due to failure of the TDRS antenna.

NOTE

The nominal SA slew time is 90 seconds, but will change to 120 seconds with TDRS H.above two steps are based on a 90 second SA slew time.

13.4 TUT Algorithm for MAF Antennas

For each MAF or SMAF antenna for each TDRS, TUT is to be determined as follows:

a. Based on the start and stop times of all MAF or SMAF services within the active schedule, identify all unscheduled blocks with durations of at least two minutes.

b. Add the MAF setup time to the beginning of each unscheduled block.

c. Subtract the MAF setup time from the end of each unscheduled block.

d. Eliminate any blocks whose resultant duration is now less than one minute (i.e., the minimum valid TDRSS service duration).

e. Eliminate any blocks that are unscheduled due to failure of the TDRS antenna.

NOTE

The nominal MAF setup time is 30 seconds.

13.5 TUT Algorithm for MAR Links

For each MAR or SMAR link for each TDRS, TUT is to be determined as follows:

a. Based on the start and stop times of all MAR or SMAR services within the active schedule, identify all unscheduled blocks. If a single event contains more than one MAR or SMAR service, any unscheduled blocks between such services within the event are to be discarded.

b. Add the MAR setup time to the beginning of each unscheduled block.

c. Subtract MAR setup time from the end of each unscheduled block.

d. Eliminate any blocks whose resultant duration is now less than one minute (i.e., the minimum valid TDRSS service duration).

e. Eliminate any blocks that are unscheduled due to failure of the TDRS antenna.

NOTE

The above nominal MAR setup time is 30 seconds.

Section 14. GN Scheduling Services

14.1 General

This section provides the modified WOTRS requirements needed for the updated Ground Network scheduling system. This system will process scheduling requests from users for ground site assets at the following sites:

1. Merritt Island/Ponce de Leon (MIL/PDL),
2. Bermuda (BDA)
3. Wallops Ground Station (WGS) (formerly Automated Wallops Orbital Tracking System, or AWOTS)
4. Alaska Ground Station (AGS) (formerly Poker Flat)
5. Alaska SAR Facility (ASF)
6. Svalbard Ground Station (SGS)
7. McMurdo Ground Station (MGS)

This approach allows all ground station assets to be managed from the DSMC using the same scheduling system.

14.2 Interface Requirements

14.2.1 External Interface Requirements (EI)

14.2.1.1 EI.1 - Receive view periods

The system shall be able to receive view periods electronically from FDF without operator intervention.

14.2.1.2 EI.2 - Accept support requests from WSM

The system shall be able to accept ASCII file formatted support requests that can be accessed from the Wallops Scheduling Mailbox (WSM).

14.2.1.3 EI.3 - Accept formatted schedules from WSM

The system shall be able to accept ASCII file formatted schedules that can be accessed from the WSM.

14.2.1.4 EI.4 - Accept formatted schedule requests from Web Interface

The system shall be able to accept file formatted schedule requests that can be accessed from the DSMC Web Scheduling Interface.

14.3 Functional Requirements

14.3.1 Service Planning: Planning Support (PS)

14.3.1.1 PS.1 - Resource definition

The system shall accommodate resource definition parameters, including, as a minimum:

- A Unique Resource Name
  - Components Which Comprise the Resource
  - Activity Assignment List
    - Interval Start/Stop Time
    - Activities Using the Resource During the Interval

14.3.1.2 PS.2 - Resource component definition

The system shall accommodate component resource definition parameters, including, as a minimum:

- A Unique Component Name
- Initial Availability List
  - Initial Availability Start/End Time
  - Initial Availability Quantity

14.3.1.3 PS.3 - WOTS activity definition

The system shall accommodate WOTS activity definition parameters, including, as a minimum:

- A Unique Activity (Project) Designator
- Operation Requested (Track, Command, Range, Playback)
- Duration of Pattern Defining Activity
- Number of Events in Pattern
- Width of Event Window
- Minimum Total Pass Length Acceptable
- Minimum Continuous Time Needed
- A Definition List for Each Event
  - Event Start Time (Absolute or Relative)
  - List of Sites, in Priority Order, Requested for Support

14.3.1.4 PS.4 - Condition definition parameters

The system shall accommodate multiple condition definition parameters, including, as a minimum:

- A Unique Condition Identification
- Condition Start/Stop Times

14.3.1.5 PS.5 - Add/delete projects

The system shall allow the user to add and delete projects.

14.3.1.6 PS.6 - Resource expansion

The system shall accommodate resource expansion by site, location, components.

14.3.1.7 PS.7 - Create/delete activities, resources, and conditions

The system shall allow the user to define new activities, resources, and conditions, or delete existing activities, resources, and conditions.

14.3.1.8 PS.8 - Edit activities, resources, and conditions

The system shall allow the user to edit existing activities, resources, and conditions.

14.3.1.9 PS.9 - Default time display

The default system display time shall be the history, event, forecast, and strawman weeks.

14.3.1.10 PS.10 - Input validation

The system shall be able to validate data inputs.

14.3.1.11 PS.11 - Text/graphical display

The system shall be able to display information in a textual and graphical format.

14.3.1.12 PS.12 - Load multiple schedules

The system shall be able to load more than one existing schedule into the system workspace simultaneously.

14.3.1.13 PS.13 - Working schedule

The system shall be able to designate a single working schedule, if more than one schedule is loaded.

14.3.1.14 PS.14 - Hardcopy

The system shall be able to generate hardcopy representations of activity and resource timelines in graphical and tabular form.

14.3.1.15 PS.15 - Filtering

The system shall provide the capability to filter displays based on time, site, organizations, and projects.

14.3.1.16 PS.16 - Remote access

The system shall be executable remotely, and allow access to schedule information from a remote terminal.

14.3.1.17 PS.17 - Display view periods

The system shall have the ability to display view periods on a timeline.

14.4 Scheduling Requirements

14.4.1 Not-Scheduled List (NS)

14.4.1.1 NS.1 - Add activities manually to Not-Scheduled list

The user shall be able to manually add one or more activities to the Not-Scheduled list.

14.4.1.2 NS.2 - Remove activities manually from Not-Scheduled list

The user shall be able to manually remove one or more activities from the Not-Scheduled list.

14.4.1.3 NS.3 - Assign priorities

The user shall be able to assign priorities to activities for scheduling purposes.

14.4.1.4 NS.4 - Schedule Not-Scheduled activities, no conflicts

The system shall be able to schedule one, all, or a user-selected subset of activities from the Not-Scheduled list, while enforcing temporal, condition, and resource constraints (i.e. add an activity to a schedule with no conflicts).

14.4.1.5 NS.5 - Schedule Not-Scheduled activities, possible conflicts

The system shall be able to schedule one, all, or a user-selected subset of activities from the Not-Scheduled list, while computing but not enforcing temporal, condition, and resource constraints (i.e. add an activity to a schedule with possible conflicts).

14.4.1.6 NS.6 - Wait list

The system shall be able to remove activities from a Wait list and reassign them to the Not-Scheduled list with increased priority to give them a better chance of being scheduled. The Wait list is a grouping of Not-Scheduled activities which the scheduling engine was unable to place into scheduled status without conflicts (i.e. scheduling failures).

14.4.2 Scheduled List (SL)

14.4.2.1 SL.1 - Manually add activity to Scheduled list

The system shall be able to manually add an activity to the Scheduled list. Conflicts will be ignored and resources will be assigned to the activity. This operation enables the immediate scheduling of resources to accommodate a S/C emergency.

14.4.2.2 SL.2 - Unschedule activities

The system shall be able to unschedule all or a user-selected subset of scheduled activities.

14.4.2.3 SL.3 - Reschedule activities

The system shall be able to reschedule an activity (i.e. unschedule an activity and attempt to schedule the activity).

14.4.2.4 SL.4 - Move activities

The system shall be able to move a scheduled activity on a timeline. Resources will be unassigned and reassigned at the new activity location. No conflict detection/resolution would occur until rescheduling had been performed. This requirement is similar to UI.7.

14.4.3 Resource Assignment (RA)

14.4.3.1 RA.1 - Define composite resources

The system shall be able to define composite resources at the component level.

14.4.3.2 RA.2 - Assign composite resources

The system shall be able to assign resources at the composite level.

14.4.3.3 RA.3 - Detect resource conflicts

The system shall be able to detect resource conflicts at the component level.

14.4.3.4 RA.4 - Report resource conflicts

The system shall be able to report resource conflicts at the component level.

14.4.3.5 RA.5 - Define Set-up Time

The system shall be able to define a Set-up Time for composite resources.

14.4.3.6 RA.6 - Revise Set-up time

The system shall allow the resource Set-up Time to be changed after scheduling, for a specific activity. Until rescheduling is performed, any conflict information could not be considered current.

14.4.4 User Interface (UI)

14.4.4.1 UI.1 - Manipulate time period

The user shall be able to manipulate the display time period.

14.4.4.2 UI.2 - Consistent look & feel

The system shall employ an integrated dialog which provides a consistent graphical look and feel.

14.4.4.3 UI.3 - Allow users to produce schedule

The system shall provide a graphical user interface which will allow users to perform schedule generation, revision, and dissemination.

14.4.4.4 UI.4 - View activity, resource, or condition information

The user shall be able to view information on any activity, resource, or condition.

14.4.4.5 UI.5 - Timeline displays

The system shall provide scheduled activity, condition, and resource timeline displays.

14.4.4.6 UI.6 - Simultaneous displays

The system shall provide for simultaneous display of several scheduled activity, condition, and resource displays.

14.4.4.7 UI.7 - Graphical activity adjustment

The user shall be able to shift an activity on a graphical display to a new start time and to modify its required resource quantity. This will release assigned resources at the old location, and the new placement will not be checked for conflicts until rescheduling has occurred. Refer to requirements SL.3,4,5.

14.4.4.8 UI.8 - Minimum number of process levels

The system shall minimize the number of process levels in order for a user to perform routine functions.

14.4.4.9 UI.9 - Horizontally scrollable display windows

The system shall accommodate horizontally scrollable display windows.

14.4.4.10 UI.10 - Vertically scrollable display windows

The system shall accommodate vertically scrollable display windows.

14.4.4.11 UI.11 - Mouse button interaction

The system shall accommodate one or more buttons on the mouse.

14.4.4.12 UI.12 - Overlaid windows

The system shall be able to display overlaid windows simultaneously.

14.4.4.13 UI.13 - Resize & drag windows

The system shall be able to resize and drag windows.

14.4.4.14 UI.14 - Crosshair graphic

The system shall provide for the use of a crosshair graphic to aid in locating the cursor and reading across a line of text.

14.4.4.15 UI.15 - Form-based data entry

The system shall incorporate a textual form-based user interface for data entry and editing.

14.4.4.16 UI.16 - On-line user help and diagnostics

The system shall incorporate a context sensitive on-line help function to answer user questions during a session, and to help the user clarify and resolve error traps.

14.4.4.17 UI.17 - Activity/Site/Resource Gannt chart display

The system shall incorporate a display which enables the user to view the graphical results of the scheduling activity in a Gannt chart form containing activities, sites, assigned resources, and view periods.

UI.18 - Resource set-up time revision

The system shall incorporate a convenient method for the user to revise the resource set-up time (e.g. a pop-up entry screen activated by double-clicking the mouse within the confines of a resource bar on the Activity/Site/Resource Gannt chart).

14.4.5 Activity Template (AT)

14.4.5.1 AT.1 - Edit Activity Templates

The user shall be able to edit (add, modify, delete) Activity Templates (default mission requests or event definition forms), changing any of the information specified in PS.3.

14.4.5.2 AT.2 - Schedule with Activity Templates

The system shall be able to automatically generate a schedule based on activity attributes and temporal, condition, and resource requirement information contained in Activity Templates.

14.4.6 Scheduling Engine (SE)

14.4.6.1 SE.1 - Generate 7-day Operations schedule

The system shall be able to generate a 7-day Operations schedule.

14.4.6.2 SE.2 - Generate 7-day Forecast schedule

The system shall be able to generate a 7-day Forecast schedule.

14.4.6.3 SE.3 - Generate 7-day Strawman schedule

The system shall be able to generate a 7-day Strawman schedule.

14.4.6.4 SE.4 - Schedule an activity within a view period

The system shall be able to schedule an activity within a specified composite view period[1].

14.4.6.5 SE.5 - Schedule an activity multiple view periods

The system shall be able to schedule an activity during one or more view periods within a specified length of time.

14.4.6.6 SE.6 - Schedule resources

The system shall be able to schedule resources based on available resource components. This requirement works in conjunction with the definition of component resources in PS.2, with the intent that, unless all components which define a resource are available, the resource will not be scheduled. The system will report, instead, on the identification and number of missing components for SP information and possible resolution.

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[1] A **composite view period** is defined as a view period which is a conjunction of a ground antenna view period, a S/C antenna view period (if specified), and an externally defined window (e.g. Auroral crossings) (if specified).

14.4.6.7 SE.7 - Schedule activities at remote sites

The system shall be able to schedule activities at remote sites.

14.4.6.8 SE.8 - Schedule common Launch Range/WOTS resources

The system shall be able to track and assign common WOTS and Launch Range resources (e.g. 24' antenna).

14.4.6.9 SE.9 - Detect resource conflicts

The system shall be able to detect resource conflicts.

14.4.6.10 SE.10 - Resolve resource conflicts

The system shall be able to attempt to resolve resource conflicts according to the definition of conflict resolution used in this document (reference Section 4.2 and footnote #5).

14.4.6.11 SE.11 - Activity window violations

The system shall be able to detect activity window violations (i.e. an attempt to schedule an activity outside of its user defined window).

14.4.6.12 SE.12 - Temporal violations

The system shall be able to detect temporal (i.e. predecessor, separation) violations.

14.4.6.13 SE.13 - View period violations

The system shall be able to detect view period (condition) violations.

14.4.6.14 SE.14 - Resource/activity control

The system shall be able to allocate and deallocate resources to/from activities, and track the utilization of resources.

14.4.6.15 SE.15 - Vary activities among sites

The system shall be capable of attempting to vary activities among sites if so defined in the Activity Template.

14.4.6.16 SE.16 - Schedule with minimum pass duration

The system shall be capable of accepting a minimum for the duration of a pass as specified in the Activity Template, and scheduling accordingly.

14.4.6.17 SE.17 - Separation between activities at a site

The system shall be capable of accepting a time separation between activities at a particular site as specified in the Activity Template, and scheduling accordingly.

14.4.6.18 SE.18 - Choice of multiple view periods

If multiple view periods meet the scheduling criteria within an activity window, the first will be chosen by default.

14.4.6.19 SE.19 - Unresolvable conflict reporting

If the scheduling process is unable to resolve a conflict as specified in SE.10, then all details pertaining to the conflict (e.g. which component of a resource is unavailable) shall be reported to the user.

14.4.6.20 SE.20 - Failure to schedule

Any activity which fails to meet the conflict-free scheduling criteria will be placed on the Wait list, and the details of the failure reported to the SP.

14.4.7 Forecasting Requirements (FR)

14.4.7.1 FR.1 - Enter new sites

The system shall have the ability to enter new site location by specifying a unique Latitude, Longitude, and Identification Designator (ID).

14.4.7.2 FR.2 - Define resources

The system shall have the ability to define new resources at a site using a generic designator which shall be appended to the unique site ID to form a unique resource designator.

14.4.7.3 FR.3 - Resource attributes

The system shall have the ability to define resource attributes for each generic resource designator.

14.4.7.4 FR.4 - Edit resource composition

The system shall have the ability to edit the resource composition at a given site.

14.4.7.5 FR.5 - Generate view period data

The system shall have the ability to generate view period information according to the condition format specified in PS.4, encompassing any desired time interval, given the S/C orbital elements, and the resource designator.

14.4.7.6 FR.6 - Detect resource conflicts

The system shall have the ability to detect resource conflicts.

14.4.7.7 FR.7 - Calculate resource loading

The system shall have the ability to calculate resource loading.

14.5 Service Control

14.5.1 Schedule Dissemination (SD)

14.5.1.1 SD.1 - Make formatted schedules available

The system shall be able to make WOTRS formatted schedules available to the user community through the WSM and the DSMC Web Scheduling Interface.

14.5.1.2 SD.2 - Disseminate 7-day Operations schedule

The system shall be able to disseminate a 7-day Operations schedule in a WSM ASCII file format.

14.5.1.3 SD.3 - Disseminate 7-day Forecast schedule

The system shall be able to disseminate a 7-day Forecast schedule in a WSM ASCII file format.

14.5.1.4 SD.4 - Disseminate 7-day Strawman schedule

The system shall be able to disseminate a 7-day Strawman schedule in a WSM ASCII file format.

14.5.1.5 SD.5 - Filter reports

The system shall be able to filter all WSM reports by site and project.

14.5.1.6 SD.6 - Change log

The system shall be able to create a change log in WSM ASCII file format.

14.6 Service Accounting

14.6.1 Information Management (IM)

14.6.1.1 IM.1 - Schedule manipulation

The system shall provide the capability to save or retrieve a new or updated schedule under a user-selected name, including saving to a user-specified, access-protected and/or public space.

14.6.1.2 IM.2 - Actuals

The system shall allow the user to add activity performance and operations management information to the activity record after the activity has occurred.

14.6.1.3 IM.3 - Export information

The system shall accommodate the export of selected information in the proper format for interfacing with an external database which may be located on a platform outside the immediate WOTRS system hardware area.

14.6.2 Database (DB)

14.6.2.1 DB.1 - Query for historical information

The system shall enable the user to query a database for historical information.

14.6.2.2 DB.2 - Report generation

The system shall enable the user to define reports for summarizing historical information.

14.6.2.3 DB.3 - Access archived information

The system shall enable the user to access archived information for at least the previous 12-month period (a 24-month period is preferred).

14.6.2.4 DB.4- Database Interface

The access to the database shall be through a user interface familiar to the majority of those persons at WFF requiring information (e.g. PCN Tracking System).

14.7 Performance & Quality Engineering Requirements

14.7.1 System Performance

The system must be able to generate feasible schedules, according to the requirements stated in sections 5.1 & 5.2 for the projected load of generically scheduled S/C (approximately 10), and specifically scheduled S/C (up to 20). After all parameters are loaded into the scheduling system for a particular scheduling run, during which the scheduling engine moves events from the Not-Scheduled list to the Scheduled list and resolves all possible conflicts, the processing time shall be on the order of minutes (less than 5), after which the system will again accept user input.

14.7.2 Error Handling

The system shall be able to detect common user errors, flag them with clear and informative messages, and loop back for corrected input. Where an error occurs at a lower level within a series of nested screens, the error should be correctable locally within the affected screen; it

should not be necessary to navigate from the root screen through several levels to relocate the working screen.

14.7.3 Reliability, Maintainability, Portability

The WOTRS software shall be well tested and robust so there is little chance of a system crash or other anomaly that could cause the destruction of data. It is expected that all code generated for the system will be self-documenting as to interfaces, purpose, and any unusual attributes. The run-time module should be self-contained so it can be moved to another workstation having like capabilities. It is understood that any changes made to the system would require the original languages and development tools used in the production of the run-time module.

14.8 Safety Requirements

There are no known safety requirements levied upon this software.

14.9 Security and Privacy Requirements

It is important to insure that all key scheduling files are under the control of the Schedule Planner and only authorized users are able use the system or modify the files. The WOTRS software is protected at two levels. First, the platform on which the software operates is password protected at the operating system level; only persons with the current password can use the system. Secondly, all scheduling files in the Schedule Planner's directory are write protected; they can be used, but not modified without authorized access. This environment and its protection scheme shall remain the same in response to these requirements.

It is mandatory that the software and all data files be backed-up to protect against system failures. Both the executable software image and all source files are under configuration management and are stored on high-density cassette tapes using a tape unit attached to the workstation. Before a new version of the software is released, it is thoroughly tested, proper documentation generated, and tape archive copies made. The critical data files within the scheduling process are also backed-up to the tape unit each week (recall that one week is the basic unit of scheduling). Any new software developed shall operate in the same environment using these established protection procedures.

14.10 Implementation Constraints

Currently, the scheduling portion of the WOTRS software runs on a Hewlett-Packard (HP) Model 720 workstation with a UNIX based operating system. The executable image has been successfully ported to Sun-4/SPARC stations, Apollo 3500, Apollo 4500, Apollo Series 400, and HP/Apollo Series 700 systems. Any system to which the system is ported, and on which more development work is to be performed, must provide X11-R4, Motif 1.1, C++ libraries, a C++ compiler, and the proprietary Information Sciences Incorporated Scheduling Management Routines (FOREST-*pls*) as support software. Several ancillary functions are provided by other hardware platforms. It is anticipated that those functions performed on Personal Computers (PC) will be moved to the workstation. The WSM will be maintained on a MicroVAX computer, but

is expected to be moved to a networked platform. The database functions, which are now supported on a PC, will be moved to the networked MicroVAX, and accessed via the existing Oracle data management system.

To the extent that the new system is built upon the existing system, the hardware requirements remain the same for system operation. Where the system is to be maintained and enhanced within the WFF community, the scheduling and support software, also, must be available on at least one development machine.

14.11 Site Adaptation

This document addresses the additional capabilities to be added to WOTRS, an operational software system. It is not anticipated that the software which will be developed to meet the requirements detailed herein will require additional hardware, although future growth in the scheduling mission makes it prudent to keep the hardware upgrade path open.

14.12 Design Goals

As the new system is designed it is very desirable for it to be partitioned so that user input, user graphical interaction, and system output are clearly divided from the scheduling engine. It will be an important goal to be able select other scheduling engines, based on other algorithms within the scheduling community (including university research), to be evaluated within the framework of the new scheduling system. If the new system is properly partitioned the local WFF programming support staff would be able to add a new scheduling engine such that the only outward appearance to the user is an additional entry on a menu designated for the choice of engines to employ.

Finally, as the new system is being designed, careful attention should be paid to reviewing the tasks now being performed on platforms external to the WOTRS workstation, with the objective of consolidating most tasks into the unified scheduling system software operating on a single workstation platform.

Section 15. Scheduling Web Interface Services (SWIS)

15.1 General

This section provides the requirements for the Scheduling Web Interface Services (SWIS). The SWIS will provide Ground Network (GN) customers with a Web-style interface to the Wallops Orbital Tracking Information System (WOTIS) scheduling system. SWIS is not a scheduling tool but does provide ubiquitous access, security, and a consistent user interface mapped to the WOTIS scheduling process. In addition, SWIS will be extensible to support commercial GN service providers.

These requirements use terms defined in the WOTIS documentation. WOTIS utilizes two methods to collect user inputs: Generic Scheduling and Specific Scheduling. In Generic Scheduling, general support requirements are submitted via email or memo to the Wallops Scheduling Office (WSO) for translation into a detailed schedule. SWIS does not input Generic Schedules. However, after the initial customer input, scheduling results are tracked using SWIS the same as Specific Schedules. In Specific Scheduling, detailed inputs are provided and can be submitted via SWIS. Generic and Specific scheduling represent initial inputs. The subsequent list of products is the same for each. A general definition of these products is shown in the following table.

Throughout this document, Customer, Mission Operations Center (MOC) and/or Project refer to the facilities of the GN scheduling customer.

Scheduling Products	*From*	*To*	*Definition*
Specific Schedule	*MOC*	*WOTIS*	*Detailed schedule input identifying GN support requirements including times and ground stations*
Strawman Schedule	*WOTIS*	*MOC*	*The subset of requested supports that can be scheduled. Defines resources available for scheduling.*
Update Schedule	*MOC*	*WOTIS*	*A response to the Strawman schedules. Refines and specifies support requirements.*
Confirmed Schedule	*WOTIS*	*MOC*	*Specifies which contacts in the Strawman schedule will be implemented. Effectively deletes contacts that are not specified.*
Daily Schedule File	*MOC*	*WOTIS*	*Near-term final refinement to a confirmed schedule*
Downlink Results File	*WOTIS*	*MOC*	*Sent to the MOC within 30 minutes after the end of the contact. Includes identifying information about the pass including Project, Ground Station (GS), Orbit, and PTP Summary Information.*
Tape Shipment File	*WOTIS*	*MOC*	*If X-Band information is recorded on tapes at the Ground Station (GS), WOTIS provides information about the tape (e.g. ID #, start address, end address) in a Tape Shipment File sent the day the tape is shipped.*
Tape Acknowledgment File	*MOC*	*WOTIS*	*Generated by the scheduling customer. Informs WOTIS if the tape was processed normally and if the data was useable. Allows WOTIS to inform the GS that the backup can be erased.*

WOTIS Scheduling Product Definitions

15.2 Data Interfaces

DSMC-SWIS-DI-00001
The SWIS shall be accessible to GN scheduling customers through the Open or Closed IONets .

DSMC-SWIS-DI-00002
The SWIS shall interface with the WOTIS, using secure shell (SSH) protocol, to exchange scheduling products.

DSMC-SWIS-DI-00003
The SWIS shall submit initial schedule request inputs from GN scheduling customers to WOTIS using the 'Specific Scheduling' process.

DSMC-SWIS-DI-00004
The SWIS shall receive 'Strawman Schedules' and 'Confirmed Schedules' from WOTIS and make these available to the GN scheduling customer.

DSMC-SWIS-DI-00005
The SWIS shall submit 'Update Schedules' to WOTIS in response to 'Strawman Schedules'.

DSMC-SWIS-DI-00006
The SWIS shall submit 'Daily Schedule Files' to WOTIS in response to 'Confirmed Schedules'

DSMC-SWIS-DI-00007
The SWIS shall receive the WOTIS 'Downlink Results File' and provide it to the requesting project.

DSMC-SWIS-DI-00008
The SWIS shall receive the WOTIS 'Tape Shipment File' and provide it to the requesting project.

DSMC-SWIS-DI-00009
The SWIS shall provide the GN scheduling customer the capability to send the 'Tape Acknowledgement File'.

DSMC-SWIS-DI-00010
The SWIS shall provide the GN scheduling customer the capability to send Ephemeris data in a WOTIS compatible format.

15.3 User Interface

DSMC-SWIS-UI-00001
The SWIS customer interface shall provide screens that feature point-and-click menus to build network schedule requests.

DSMC-SWIS-UI-00002
The SWIS menus shall identify fields that customers must complete in order to satisfy the minimum information needed by the DSMC to perform the requested scheduling action.

DSMC-SWIS-UI-00003
The SWIS customer interfaces shall display unscheduled time by supporting station.

DSMC-SWIS-UI-00004
The SWIS customer interface shall provide the capability to create and submit the initial schedule for WOTIS 'Specific Scheduling' inputs.

DSMC-SWIS-UI-00005
The SWIS customer interface shall provide the capability to edit the schedule responses and submit 'Schedule Updates' and 'Daily Schedules'.

DSMC-SWIS-UI-00006
The SWIS customer interface shall provide the capability for the customer to get the 'Downlink Results File' and the 'Customer Tape Report' and to submit the 'Tape Acknowledgement File'.

DSMC-SWIS-UI-00007
The SWIS customer interface shall provide contact information for scheduling operators including voice telephone, FAX, and email.

DSMC-SWIS-UI-00008
SWIS shall support versions of the following web browsers which are compatible with HTML 4.0, Java version 1.2 and Java Script version 1.3 running on IBM-PC-compatible platforms:

a) Netscape Navigator
b) Internet Explorer

15.4 Performance

DSMC-SWIS-PF-00001
From the time a user submits a weekly schedule request until the schedule file is received at the WOTIS shall be no more than 10 seconds.

DSMC-SWIS-PF-00002
From the time a user requests to view or edit a single day schedule until the schedule is displayed shall be no more than 10 seconds.

DSMC-SWIS-PF-00003
The time required for a user to save a single day's schedule shall be no more than 10 seconds.

DSMC-SWIS-PF-00004
From the time a user requests to view a downlink summary for a single day's worth of passes until the downlink summary is displayed shall be no more than 15 seconds.

DSMC-SWIS-PF-00005
From the time a user requests to view a downlink report for a single pass until the downlink report is displayed shall be no more than 10 seconds.

DSMC-SWIS-PF-00006
From the time a user requests to view a tape summary for a single day's worth of passes until the tape summary is displayed shall be no more than 15 seconds.

DSMC-SWIS-PF-00007
From the time a user requests to view the unused GN time for a single day until the unused time is displayed shall be no more than 15 seconds.

DSMC-SWIS-PF-00008
The SWIS customer interface shall support a minimum of 30 customers concurrently.

Section 16. Service Accounting System Replacement (SASR)

16.1 General

This section provides the requirements for the Service Accounting Segment Replacement (SASR). SASR will provide service accounting for the actual utilization and performance of the SN and GN against scheduled support. This data is used support of the Network and Service Utilization Data (DRD 2.4.2.7), and Performance Measurement Plan and Reports (DRD 2.1.4).

16.2 Data Interfaces

DSMC-SASR-DI-00001
SASR shall interface with the SN scheduling system to retrieve actual SN schedule history.

DSMC-SASR-DI-00001.1
SASR shall extract SN schedule records from the SPSR scheduling database system. These records will be combined with operator entered outage reports to generate service accounting reports.

DSMC-SASR-DI-00002
SASR shall interface with the GN scheduling system to retrieve actual GN schedule history.

DSMC-SASR-DI-00002.1
SASR shall extract GN schedule records from the WOTIS scheduling database system. These records will be combined with operator entered outage reports to generate service accounting reports

DSMC-SASR-DI-00003
SASR shall access the WOTIS database to extract pass summary information. This information will be used to develop operator inputs GN service outages.

DSMC-SASR-DI-00004
All reports delivered by SASR shall be encrypted to assure data privacy to the requesting user.

16.3 User Interface

DSMC-SASR-UI-00005
The SASR user interface shall allow the operator to create and update an outage report associated with a pass, including free form text.

DSMC-SASR-UI-00006
SASR shall, in addition to User Authentication and User Access control features, provide a system administrator level that enables access to all features and reports available at the SASR user interface.

DSMC-SASR-UI-00007
The SASR user interface shall allow for information extraction from daily pass summary messages for inclusion in outage reports by the operator.

DSMC-SASR-UI-00008
SASR shall provide a web based graphical user interface (GUI) for accessing fixed format SN and GN schedule accounting reports

DSMC-SASR-UI-00008.1
The SASR GUI shall be accessible only to users using a standard web browser from a PC or PCs on the NCC network.

DSMC-SASR-UI-00008.2
SASR shall support versions of the following web browsers which are compatible with HTML 4.0, Java version 1.2 and Java Script version 1.3 running on IBM-PC-compatible platforms:

a) Netscape Navigator
b) Internet Explorer

DSMC-SASR-UI-00009
SASR shall provide a user authentication system to assure that only authorized users shall have access to the web based SASR functions. A user shall be considered authorized if the user's requests originate within the NCC network. Such a user shall be considered to have system administrator privileges (i.e., allowed to use all features and request any reports available from the SASR user interface)

DSMC-SASR-UI-00010
SASR shall control access to fixed format SN and GN scheduling accounting reports based on user access privileges.

DSMC-SASR-UI-00011

The functionality available via the web based SASR GUI shall be provided for users connected to the NCCDS

16.4 Report Generation

DSMC-SASR-RG-00012

SASR shall provide the operator a pre-defined, automated report generation capability (i.e. interval, generation date, etc.).

DSMC-SASR-RG-00013

SASR shall provide SN and GN schedule accounting reports in pre-defined fixed formats.

DSMC-SASR-RG-00014

SASR shall be delivered with the fixed report formats shown in table 16-1.

DSMC-SASR-RG-00015

SASR shall provide tools for the operator to define new fixed format reports and to provide access to these reports to SASR users.

DSMC-SASR-RG-00016

SASR shall populate fixed format reports based on user inputs defining start and end date for the requested report.

DSMC-SASR-RG-00016.1

Start and end date options for SASR fixed format report requests shall be include specific start and stop times, calendar month, and fiscal month.

DSMC-SASR-RG-00017

SASR fixed format reports shall be delivered in an ASCII text, HTML, or PDF file formats.

DSMC-SASR-RG-00018

SASR shall provide ad hoc report generation capability using any combination of database fields specified by the operator.

DSMC-SASR-RG-00018.1

SASR ad hoc reports shall be provided in ASCII text file, HTML, or PDF formats.

DSMC-SASR-RG-00018.2

SASR ad hoc reports shall be produced using tools available at the SASR operator console.

DSMC-SASR-RG-00019

Users supporting DRD's shall use the SASR User Interface and the User Authentication, User Access, and Data Privacy features of the SASR User Interface system to retrieve the SN and GN schedule accounting reports.

16.5 Data Storage

DSMC-SASR-DS-00020

SASR shall provide the capacity to archive 6 months of historical data.

Table 16-1. SASR Predefined Report Matrix

Report ID	Report Name	Report Description
SN1	SN Support Summary – Part 1 – Scheduled Support Scheduled Minutes of Support for Each Service	This report is provided for each TDRS, which provided support, and one for the total support for all TDRSs for WSGT and STGT. These reports belong to the same request group.
SN2	SN Support Summary – Part 2 – Actual Support Actual Minutes of Support for Each Service	This report is provided for each TDRS, which provided support, and one for the total support for all TDRSs for WSGT and STGT. These reports belong to the same request group
SN3 *	Section 2 Support Summary for the Period: xx-xxx thru xx-xxx {Part A ! Part AT} Scheduled and Actual Support Time (MINS) by Spacecraft and Service	This report is provided for each TDRS, which provided support, and one for the total support for all TDRSs for WSGT and STGT. These reports belong to the same request group
SN4 *	Section 2 Support Summary for the Period: xx-xxx thru xx-xxx Part A**T** Scheduled and Actual Support Time (MINS) by Spacecraft and Service	This report is provided for all TDRSs for WSGT and STGT. This report is similar to SN3 except the BRTS S/C rows are not included and is restricted to entries with a value of 'EE' for characters 6 and 7 of the SUPIDEN (test support only).
SN5 *	TDRS Operations Summary Report for the Period: xx-xxx thru xx-xxx	This report is provided for each reimbursable project. The format for the columns is to be

Table 16-1. SASR Predefined Report Matrix

Report ID	Report Name	Report Description
	Spacecraft Events and Services Supported by Link and TDRS	fixed with the following headings (TDRS EAST-F4), (TDRS WEST – F5) and (TDRS SPARES F3, F6, F7, F8). . These reports belong to the same request group
SN6	SN Special Summary for the Period: xx-xxx thru xx-xxx Events Scheduled and Time (MINS) by Spacecraft and Support Type	This report includes only the reimbursable projects.
SN7 *	Data Selected for 12 Hour Deletes Support Summary	This report includes all Scheduled Events, which were deleted within 12 hours of the Event Start Time for each reimbursable project. Seems to be sorted by project/spacecraft, TDRS ID and then SHOID. Reference SN8 for format.
SN8 *	Data Selected for Special SN Support Summary	This report includes all Scheduled Events for the specified interval for each reimbursable project. Sorted by TDRS ID and then SHOID. Seems to be sorted by project/spacecraft, TDRS ID and then SHOID.
SN9	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part A Scheduled and Actual Support Time (MINS) by Service and Julian Day	This report is provided for each SP&M S/C for each TDRS used. Only the days for which there was support provide are included in the report.
SN10	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part A Scheduled and Actual Support Time (MINS) by Spacecraft and Service	This report is provided for each TDRS, which provided support, and one for the total support for all TDRSs for WSGT and STGT. These reports belong to the same request group. Includes all S/C.
SN11	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part A**T** Scheduled and Actual Support Time (MINS) by Spacecraft and Service	This report includes total support for all TDRSs for WSGT and STGT for all SP&M S/C. There is one report for each Support Function Code supported. These reports belong to the same request group.

Table 16-1. SASR Predefined Report Matrix

Report ID	Report Name	Report Description
SN12	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part A**T2** Scheduled and Actual Support Time (MINS) by Spacecraft and Service	This report includes total support for all TDRSs for WSGT and STGT for all Support Function Codes for all SP&M S/C.
SN13	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part GT Scheduled and Actual Support Time (MINS) by Spacecraft and Support Type	This report includes total support for all TDRSs for WSGT and STGT for all SP&M S/C.
SN14	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part E Scheduled and Actual Support Time and Events by Class and Type	This report is provided for each SP&M project/spacecraft. The format for the columns is to be fixed with the following headings (TDRS EAST-F4), (TDRS WEST – F5) and (TDRS SPARES F3, F6, F7, F8). . These reports belong to the same request group
SN15	SP&M SN Summary Report for Adds within 45 MINS of Event Start	This report includes all Scheduled Events, which were scheduled within 45 minutes of the Event Start Time for each SP&M S/C. Sorted by spacecraft, FUNC Code, TDRS ID and then SHO ID.
SN16	SP&M SN Summary Report for Events Deleted within 12 Hours of Event Start	This report includes all Scheduled Events, which were deleted within 12 hours of the Event Start Time for each SP&M S/C. Sorted by spacecraft, FUNC Code, TDRS ID and then SHO ID.
SN17	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part D Scheduled and Actual Support Time (MINS) by Spacecraft and Antenna	This report is provided for each TDRS, which provided support. These reports belong to the same request group. Includes each SP&M S/C.
SN18	SP&M SN Special Support Summary for the Period: xx-xxx thru xx-xxx Part A Scheduled and Actual Support Time (MINS) by Spacecraft and Service	This report is provided for each TDRS that provided support. These reports belong to the same request group. Includes each SP&M S/C.

Table 16-1. SASR Predefined Report Matrix

Report ID	Report Name	Report Description
SN19	SP&M Data Selected for Special SN Summary Report – Good Events	This report includes all Scheduled events for each SP&M S/C. Sorted by spacecraft, FUNC Code, TDRS ID and then SHO ID.
GN1	aaa Project Totals for dd-mmm-yy	Provides a report for each Ground Station which includes the Count and Minutes of support for each Project for Support Types: SUPPORT, TESTS, and PLAYBACK
GN2	Total Project Counts for dd-mmm-yy	This report includes the Count for each Project for each Ground Station for Support Types: SUPPORT, TESTS, and PLAYBACK
GN3	Project Totals in Minutes for dd-mmm-yy	This report includes the Minutes of Support for each Project for each Ground Station for Support Types: SUPPORT, TESTS, and PLAYBACK

Terms used in Table:

1. "Actual Events" are defined as the "Scheduled Events" minus the "Deleted (Canceled) Events."
2. "Scheduled Events" are defined as the events that are sent to the ground terminal from the NCC
3. "Scheduled Minutes" is defined as the total number of minutes scheduled for a service for the "Actual Events."
4. "Actual Minutes" is defined as the total number of minutes scheduled for a service for the "Actual Events" minus the minutes lost to network induced outages or loss of support.
5. Request Group is a group of reports that are run as a result of one request.
6. TD = TDRS ID
7. *TYPE – The first digit is the Service Subtype. The second digit is the Service Type.
8. *ST – This is the Event Status.
9. GT = Ground Terminal ID (actually a derived ID – Assume 1 = WSGT and 2= STGT)
10. FN CD – This is the Function Code extracted from the last 2 characters of the SUPIDEN
11. SHO Class is either Normal or End-to-End Test. The value under this column is the same as the ANTENNA-SERVICE for the comparable non-SP&M report.
12. FUNC CODE is same as FN CD above.
13. SERV NUMB is the Service Sequence Number.
14. Count is the number of passes supported
15. Support Type is the type of support provided to a project (Normal Support, Test or Playback)

Section 17. DSMC Firewalls

17.1 General

This section provides requirements for any firewalls which are added to the NCC subsystem as a result of the creation of the DSMC facility.

17.2 Connectivity

17.2.1 DSMC security services shall provide a firewall service for control of IP-based network connectivity to the DSMC from external networks.

17.2.2 DSMC firewall service shall provide external connectivity to services on the firewall itself to only those services and applications that are specified and required for operation.

17.2.3 DSMC firewall service shall provide external connectivity to internal DSMC systems to only those applications and services that are specified and allowed for remote DSMC operations.

17.3 Local and Remote Access

17.3.1 DSMC firewall service shall only permit login access to the firewall itself by the system administrator. If remote access is required for administration and maintenance, the login shall be protected by a secure means that is authenticated, encrypted, and audited.

17.3.2 DSMC firewall service shall log all attempts at remote user authentication.

17.3.3 DSMC firewall services shall permit access to and from external networks and the World Wide Web.

Abbreviations and Acronyms

ACRS	Automated Conflict Resolution System
AGS	Alaska Ground Station
ASCII	American Standard Code for Information Interchange
BDA	Bermuda UHF Station
BER	bit error rate
BITE	built-in test equipment
BRTS	Bilateration Ranging Transponder System
b/sec	bits per second
CCI	common-carrier interface
CCS	Communications and Control Segment
CCTV	closed-circuit television
CPU	central processing unit
CSOC	Consolidated Space Operations Contract
CTOCC	Consolidated TDRSS Operations Control Center
DAA	Designated Approving Authority
DB	Data Base Analyst
DBMS	database management system
DCN	document change notice
DIS	Data Interface System
DMS	digital matrix switch
DPI	Data Processing Installation
DQM	data quality monitoring
DSMC	Data Services Management Center
EDOS	EOS Data and Operations System
ELV	Expendable Launch Vehicle
EOS	Earth Observing System

ETRO	estimated time of return to operation
FDF	Flight Dynamics Facility
GCM	Ground Control Message
GCMR	Ground Control Message Request
GN	Ground Network
GRGT	Guam Remote Ground Terminal
GSFC	Goddard Space Flight Center
HDRM	high data rate multiplexer
HDRR	high data rate recorder
IA	interface agreement
ICD	interface control document
ID	identification
IFL	interfacility link
IIRV	Improved Interrange Vector
I/O	input/output
IP	Internet Protocol
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
kb/sec	kilobits per second
KaSA	Ka-band single access
KaSAF	Ka-band single access forward
KaSAR	Ka-band single access return
KuSA	Ku-band single access
KuSAF	Ku-band single access forward
KuSAR	Ku-band single access return
LRU	line replaceable unit
MA	multiple access
MAF	multiple access forward
MAR	multiple access return

Mb/sec	megabits per second
MDM	multiplexer/demultiplexer
MGS	McMurdo Ground Station
MI	Mutual Interference
MIL	Merritt Island, FL
MOC	Mission Operations Center
MRR	Mission Requirements Request
MSFC	Marshall Space Flight Center
MTBF	mean time between failures
MTTR	mean time to repair
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NCC	Network Control Center
NCCDS	NCC Data System
NEC	Nascom Event Cancel
NES	Nascom Event Schedule
NEST	NISN Event Scheduling Terminal
NISDDT	Nascom Interface Standard for Digital Data Transmission
NISN	NASA Integrated Services Network
NM	Network Manager
NTS	NCC Test System
OCR	operations control room
ODM	Operations Data Message
OPM	Operations Message
PA	Performance Analyst
PCD	Project Commitment Document
PDL	Ponce de Leon Tracking Station
PM	preventive maintenance
PN	pseudorandom noise

PTP	programmable telemetry processor
RASM	Remote Access Schedule Mailbox
RFI	radio frequency interference
RMA	reliability/maintainability/availability
RUST	Remote User Scheduling Terminal
SA	single access
SAR	Schedule Add Request
SASR	Schedule Accounting Segement Replacement
SDPF	Sensor Data Processing Facility
SDSS	Shuttle Data Select Switch
SGL	space-to-ground link
SGLT	space-to-ground link terminal
SGS	Svalbard Ground Station
SHO	Scheduling Order Data Message
SIC	support identification code
SLR	Service Level Report
SMA	S-band multiple access
SMAF	S-band multiple access forward
SMAR	S-band multiple access return
SN	Space Network
SOC	Simulation Operations Center
SRM	Schedule Result Message
SRR	Schedule Result Request
SS	System Supervisor
SSA	S-band single access
SSAF	S-band single access forward
SSAR	S-band single access return
SSC	service specification code
SSH	Secure Shell

STDN	Spaceflight Tracking and Data Network
STGT	Second TDRSS Ground Terminal
STRS	schedule transmission rule set
SUPIDEN	support identifier
SWIS	Scheduling Web Interface System
TBR	to be reviewed
TCP	Transmission Control Protocol
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TLAS	TDRSS Look Angle System
TNC	TDRSS Network Controller
TOTS	Transportable Orbital Tracking System
TSW	TDRS Scheduling Window
TUT	TDRSS Unscheduled Time
USM	User Schedule Message
UTC	Coordinated Universal Time
VIC	vehicle identification code
VID	vehicle ID
VTRS	vector transmission rule set
WSC	White Sands Complex
WSM	Wallops Scheduling Mailbox
WDISC	WSC TCP/IP Data Interface Service Capability
WFF	Wallops Flight Facility
WGS	Wallops Ground Station
WOTIS	Wallops Orbital Tracking Information System
WOTRS	Wallops Orbital Tracking & Range Scheduling
WOTS	Wallops Orbital Tracking Station
WSGT	White Sands Ground Terminal
WSM	Wallops Scheduling Mailbox

Glossary

acknowledgment	Confirmation of receipt of message, according to communication protocol.
acquisition data	Spacecraft orbit data used to determine TDRS antenna pointing and Doppler compensation. This includes IIRVs.
active period	The period of time covered by published schedules.
active schedule	The active schedule includes all events for which customer schedules have been disseminated.
Alternate SAR	A request to add a single event to the schedule if a referenced request fails to add an event to the schedule.
automatic schedule update phase	The time period during which incoming schedule add requests will be automatically processed.
batch schedule phase	The time period during which incoming schedule add requests will be batch processed under operator control.
conflict	A situation that occurs when a request for network resources cannot be granted.
conflict resolution (automatic)	Process in the NCCDS which attempts to schedule requested events when more than one event requests or is allocated the same resource.
current schedule	See active schedule.
customer	Any entity that makes use of the STDN for operations, simulations, or testing.
database	The data stored by the NCCDS.
data stream	An independent data signal contained within a service. I and Q channels are separated data streams within a service.
data stream ID	An identifier for each data stream.
declined request	A schedule request that has been processed without placing an event on the schedule.
delete request	A specific schedule request to delete a scheduled event.
delta-T	The time interval by which each component of a given set of acquisition data is to be moved in time.

dynamic display	A display whose contents are automatically updated to reflect new or changed data.
end-to-end test	A TDRSS service used to simulate customer satellite K- and S-band communications.
event	The scheduled occurrence of support consisting of a group of services for one SUPIDEN for one TDRS for one contiguous time interval.
event start tolerances	These are the plus and minus values specifying the time that an event can be shifted forward or backward to resolve a conflict.
event termination	The end of an event, either at its normally scheduled termination time, or when requested by the customer or an NCC console operator.
formatted message	A high-speed message whose text is fully specified in advance by a known set of values to express the contents of any field in the message.
free text	A high-speed message whose format and content are not specified in a manner that permits automatic processing.
Ground Control Message	A message used to change reconfigurable parameters in an ongoing service.
hardcopy	Any human-readable, machine-generated output that retrains its attribute of human readability when physically removed from the machine that generated it.
high-speed message	A message passed from computer to computer over high-capacity data lines.
interface channel	A Nascom communication data channel connecting SN elements and customer facilities.
interference	A degradation in communication due to noise.
multiple access	The S-band communications capability in TDRSS which provides one forward and five simultaneous return links per TDRS using phased array techniques.
ODM data packet	The portion of an ODM reporting the performance data for a single service.
overlapping support	Refers to a period of simultaneous support for one spacecraft to effect a change of TDRSs or antennas on a TDRS.

prototype event	A predefined combination of service configurations for service durations, and relative start times defined for a specific customer spacecraft to be used in the scheduling process.
radio frequency interference	RFI occurs when two or more simultaneously transmitting radiations of identical polarity with overlapping bandwidths are received by a supporting antenna.
reconfiguration	A real-time change in one or more parameters of a service.
Replace Request	A customer request to delete a scheduled event and replace it with another. If the NCCDS is unable to effect the replacement, the original event remains on the schedule.
request ID	An identification number assigned by the requester to a specific request.
S-band multiple access	A more advanced form of multiple access available on TDRS H, I, and J, but not available on earlier TDRSs. Note that although all TDRS multiple access services operate within the S-band frequencies only the multiple access services on TDRS H, I, and J are termed S-band multiple access. Refer to multiple access.
Schedule Add Request (SAR)	A specific schedule request to add a single event to the schedule.
schedule dissemination	The process by which the NCC transmits schedules to customers and SN elements, including customer facilities, TDRSS, ground stations, Nascom, FDF, and SDPF.
schedule generation period	The period of time in advance of publication (transmission) of the weekly schedule, during which the schedule is developed.
schedule generation process	This process produces events through the use of recurrent scheduling requirements, prototype events, configuration codes, and specific requests for customers.
schedule request	See specific schedule request.
schedule transmission rule set (STRS)	A set of operator-specified rules used to control the transmission of schedules.
Scheduling Order Data message (SHO)	A message sent to WSGT and STGT that defines the scheduled services and parameter values for a particular event. Each SHO has a unique identifier called the SHO ID.
Second TDRSS Ground Terminal	One of two ground facilities for support of TDRS and communications services.

service	A service describes a functional type of support for a customer for a continuous period of time. Services include forward links, return links, tracking, and end-to-end test.
Service Level Report (SLR)	A message from TDRSS concerning the operational capabilities of a particular service. It will indicate if a service is operable (green) or not operable (red).
service specification code	A set of data that specifies the initial configuration of a service for a given customer.
set-up time	While preparing to support an event, that time required to properly configure equipment.
single access (SA)	Refers to one of the steerable antennas on a TDRS; also refers to a service supported by such an antenna.
SN elements	TDRSS, NCC, SOC, NISN, FDF.
specific schedule request	A request to change a customer schedule (e.g., add or delete an event).
start time tolerances	See event start tolerances.
status report	Refer to Service Level Report.
SUPIDEN (Support Identifier)	SUPIDEN is a seven-character code used to identify the satellite or task being supported. It is broken into three parts: class, SIC, and function. Class identifies the major entity for which the support is being provided (e.g., Houston, network, GSFC). The SIC identifies the mission being requested. The function is an identification of the type of support being provided (e.g., launch simulator). SUPIDEN codes and their meanings are explained in 534-808.
Support Identification Code (SIC)	The unique four-character numeric indicator for a mission. Refer also to SUPIDEN.
TDRS Scheduling Window	A period of time during which the SN can provide support to a customer on a specified TDRS.
Tracking and Data Relay Satellite (TDRS)	A communications relay satellite used as the link between the TDRSS ground station and the customer satellites.
TDRSS Unscheduled Time (TUT)	Time within SN active schedule that has not been allocated for customer support. Lists of TUT are distributed to customers to assist them in performing schedule updates.
tracking schedule	A list of events with tracking services and times of occurrence.

vector transmission rule set (STRS)	A set of operator-specified rules used to control the transmission of vectors.
wait list	A list of declined requests that are reprocessed when resources are relinquished by events being deleted from the active schedule.
Wait List Request	A request to place a declined request on the wait list.
weekly schedule	The weekly schedule contains the events scheduled by the schedule generation run.
White Sands Ground Terminal	One of two ground facilities for support and control of TDRS and communications services.